A CLINICAL ANALYSIS ON OCULAR INJURIES IN SCHOOL GOING CHILDREN

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SUBMITTED FOR M.S.[OPHTHALMOLOGY]

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DECLARATION

I **Dr.Y.RAGAVI** solemnly declare that this dissertation entitled **"A CLINICAL ANALYSIS ON OCULAR INJURIES IN SCHOOL GOING CHILDREN**" is a bonafide record of work done by me in the Department of Ophthalmology, Thanjavur Medical College, Thanjavur under the guidance and Supervision of my Professor **Dr.J.Gnanaselvan M.S.,D.O.,** the Head of the Department, Department of Ophthalmology, Thanjavur Medical college, Thanjavur between May 2015 – May 2018.

This dissertation is submitted to The Tamilnadu Dr.M.G.R Medical University, Chennai in partial fulfillment of University regulations for the award of M.S Degree (Branch III) in Ophthalmology to be held in May 2018.

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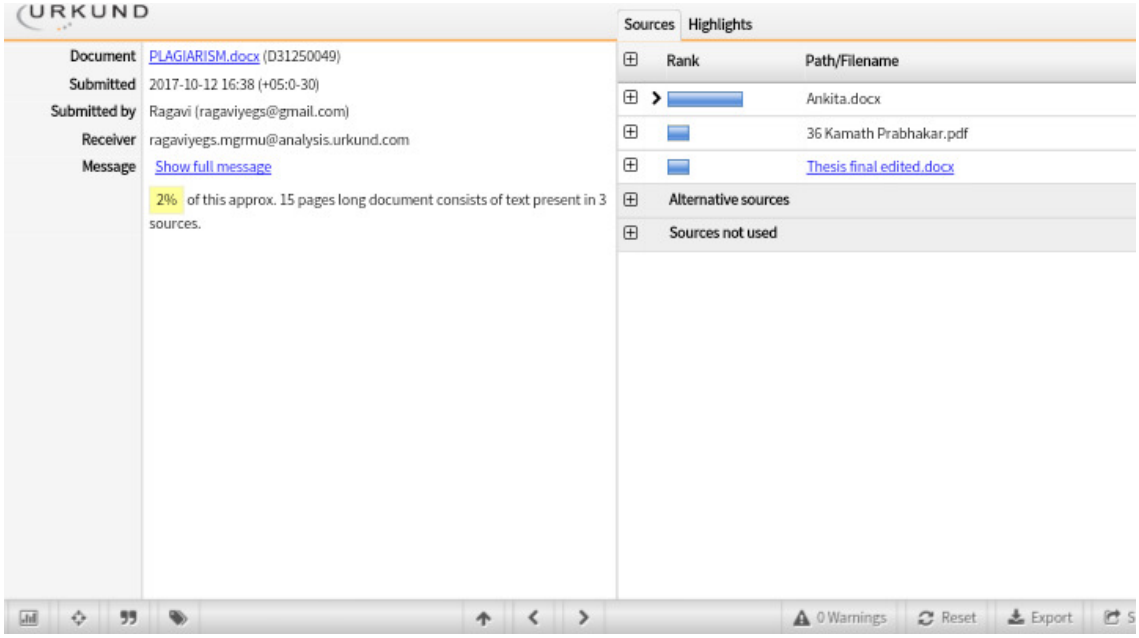
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CONTENTS

PART I

INTRODUCTION

INTRODUCTION

The eye is a highly evolved sense organ which provides a three dimensional view of the surroundings. It contributes to about 40% of sensory input to the brain. Ocular trauma is a major cause of preventable monocular blindness in the world.

About 18 million people have unilateral blindness worldwide due to traumatic injury. Injuries are more common in childhood. Every year approximately about a quarter of a million children present with serious ocular trauma. Ocular injuries account for about 8-14% of total injuries in children. The sad part of it is that a vast majority of the injury is preventable.

The number of boys hospitalized for eye trauma was twice that of females. This may be due to more aggressive behaviour in boys and also a greater involvement in high risk activities when compared to females. Children are more susceptible to eye injuries because they are immature and their tendency to imitate adult behavior without evaluating risks, ignorance, and natural curiosity.

Ocular trauma leads to visual impairment, cosmetic problems and is associated with psychosocial problems. Most of the ocular trauma is preventable by simple measures, literacy and awareness. Visual loss due to trauma is irreversible and hence prevention of trauma is of paramount importance.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Ocular trauma in school going children is a major cause of preventable monocular blindness in the world. In younger children, most accidental ocular trauma occurs during casual play with other children. Despite its public health importance, there is relatively less population-based data on the magnitude and risk factors for ocular trauma, especially from developing countries.

Although many ophthalmologists have contributed enough literature regarding ocular trauma, few were given below.

Rudolf Berlin(1873) was the first person to interpret the importance of clinical observation through crucial test of experiments. His name is immortalised in “Berlins Oedema”, the dramatic changes that appear in the retina following injury. Ogilivie(1900) has put forward a detailed theory to explain the mechanism of contusion injury of the globe, which is circumferential lateral distention to compensate for the sudden antero-posterior compression of the globe. (1)

Courville(1942-1962) introduced the coup and counter coup injury concept to explain brain damage caused by blunt trauma to the head. Wolter (1963) later used this concept to explain eye injuries.

There is little doubt of the burden of suffering caused globally by eye injury. Pizzarello(1998) stated injury "…is probably the first or second cause of monocular blindness in the world" having an immense impact on the individual, their family and community. Eye injury as a cause of blindness is rather unique as "nearly 90% of this blindness can be prevented by relatively simple measures" (Pizzarello 1998) .(1)

Negrel & Thylefors (1998) presented a global perspective by stating a total of 1.6 million cases of blindness are due to eye injuries, with some 2.3 million people suffering low vision, and another 19 million people having monocular blindness due to eye injuries. The authors agree with the Pizzarello(1998) estimate of 90% of eye injuries being preventable when "appropriate eye safety practices had been made available and effectively used". Thompson, Kumar, Billson &Martin(2002) also align with this estimate.(1).

Thompson, Kumar, Billson & Martin(2002) described a study on a cohort of full thickness penetrating eye injuries (PEI) presenting to Royal Alexandra Hospital for Children between Jan 1st 1983-Dec 31st 1999. 72 cases were reported with an age range of 7 months to 14 years. The most common cause of PEI was sharp tool e.g. knives, scissors poked into child's eye by themselves (17%) or objects thrown at the child (17%).PEI was most common in 3-6 year olds, followed by 6-9 year old group, with the ratio of males to females being 2:1. (1)

Rostomian et al(1998) reported on open globe injuries in children from 0-15 years at Children's Hospital Los Angeles from 1980-1993. 70 children were included in the study, with an average age of 5 years. Sharp objects accounted for 67% of injuries, and the most common place for injuries to occur was in the home "where presumably there would be more adult supervision than in other settings". When reporting on outcome, the authors found children who had suffered sharp object injury had a better visual outcome than those with blunt trauma.(1)

Rodriguez, Lavina and Agarwal(2003) stated that more than 40 000 eye injuries in America were related to sports and recreational activities, and that 30% of these injuries in children were sports related .

MacEwan, Baines and Desai(1999) reported on a Scottish study of children 14 years or less admitted with eye trauma. There were 93 children in the sample, 70% boys and 30% girls; 84% of children were in the 5-14 age group. The most common injury was blunt trauma (65%), then penetrating injuries without retained foreign bodies (24%); 60% of children had hyphaemas. The most common place for eye injury to occur was in the home, "…accounting for more than 50 % of all accidents".

Soylu, Demircan, Yalaz and Isiguzel(1998) reported on the aetiology of pediatric perforating eye injuries in Southern Turkey, in a group of 242

children, aged 14 years & less from August 1988 to August 1995. The mean age of children was 8 years, with 73% boys and 27% girls. The age group with highest incidence of penetrating eye injury was 5-9 years.(1)

Martin(2002) commented “children account for 20-50% of all ocular injuries” .Fong(1995) reported on paediatric eye injuries in Victoria and found over a 12 month period, children aged less than 15 years comprised 25% of hospitalisations with severe injuries including ruptured globes & hyphaemas.

ANATOMY

ANATOMY RELATED TO OCULAR TRAUMA

Orbits are two bony cavities which contain the eyeball together with its associated muscles, blood vessels, fat, nerves, and lacrimal apparatus. It is a four sided pyramid with apex, base, roof, floor, medial and lateral wall which protects, supports and maximizes the function of the eye .Derived from cranial neural crest cells, the seven bones that make up the orbit are

1. Frontal bone
2. Maxillary bone
3. Zygomatic bone
4. Lacrimal bone
5. Ethmoidal bone
6. Sphenoid bone
7. Palatine bone

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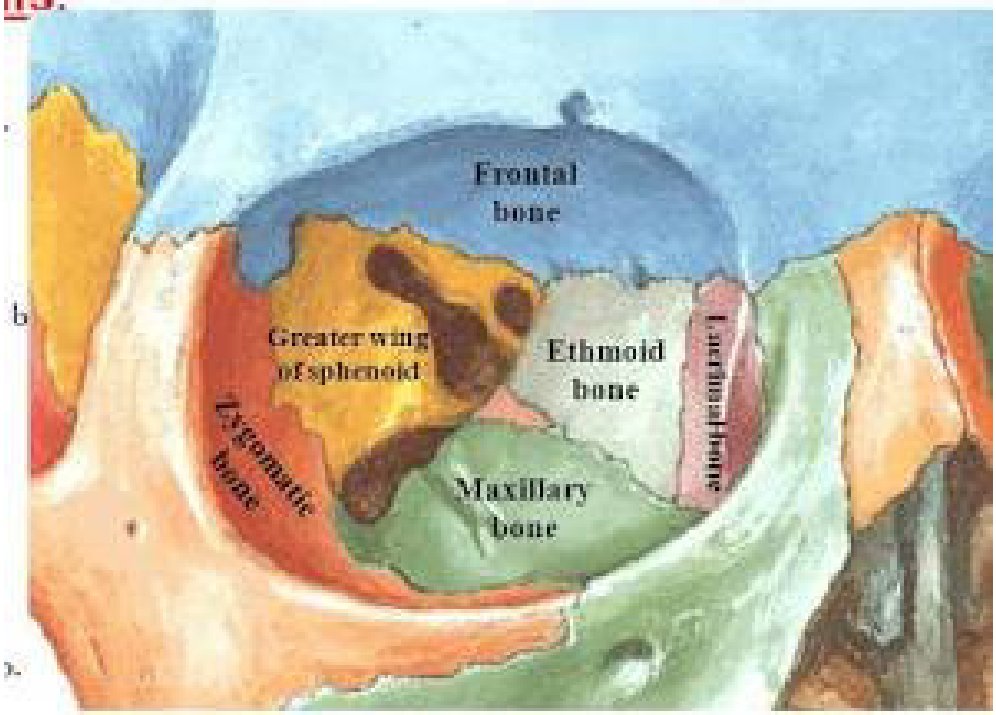
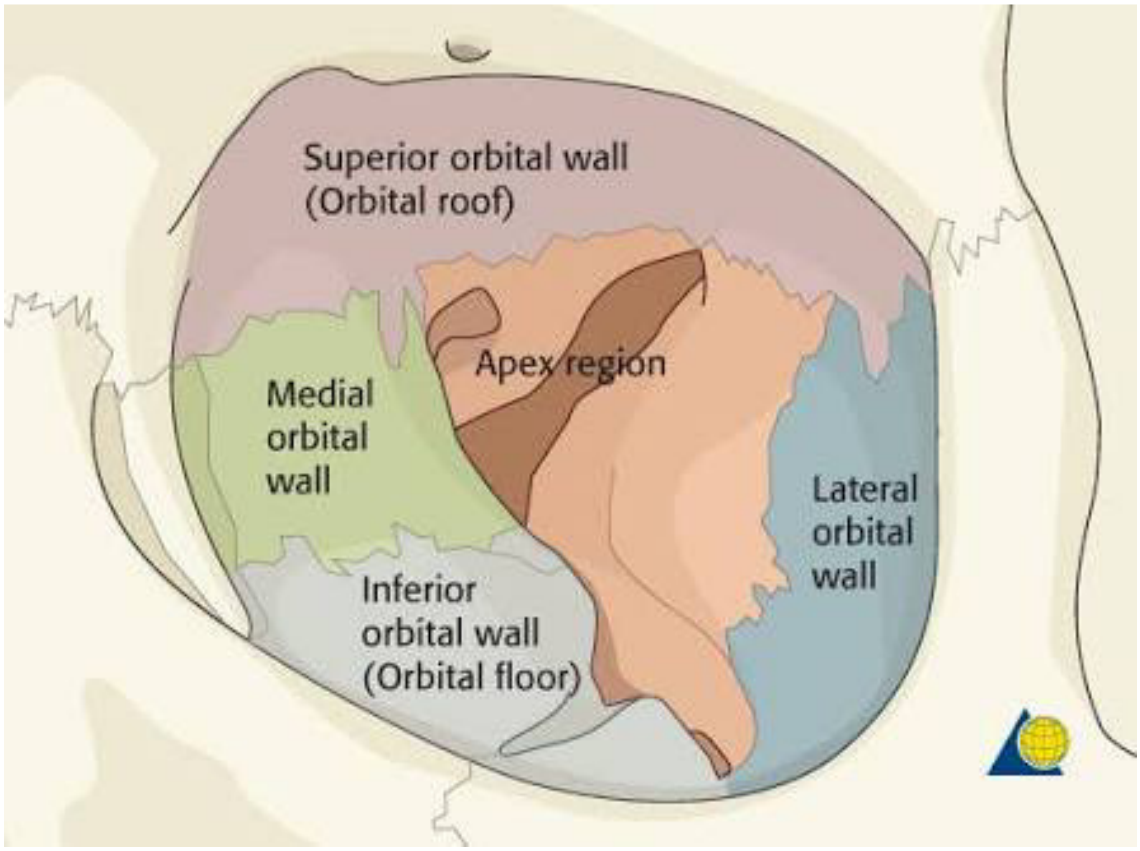

Frontal bone
Greater wing of sphenoid
Ethmoid bone
Lacrimal bone
Zygomatic bone
Maxillary bone

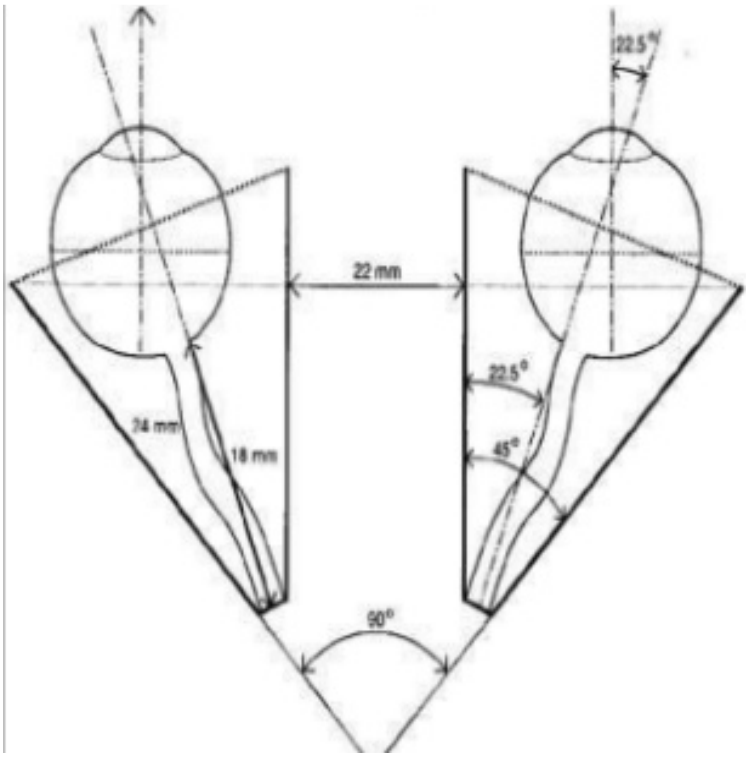
The orbit is a pear shaped cavity. The walls of the orbit are

ROOF	Orbital plate of Frontal bone, Lesser wing of sphenoid
MEDIAL WALL	Maxillary, lacrimal, ethmoid, sphenoid
LATERAL WALL	Greater wing of sphenoid, zygomatic
FLOOR	Zygomatic, maxillary, palatine


Superior orbital wall
(Orbital roof)
Apex region
Medial
orbital
wall
Lateral
orbital
wall
Inferior
orbital wall
(Orbital floor)

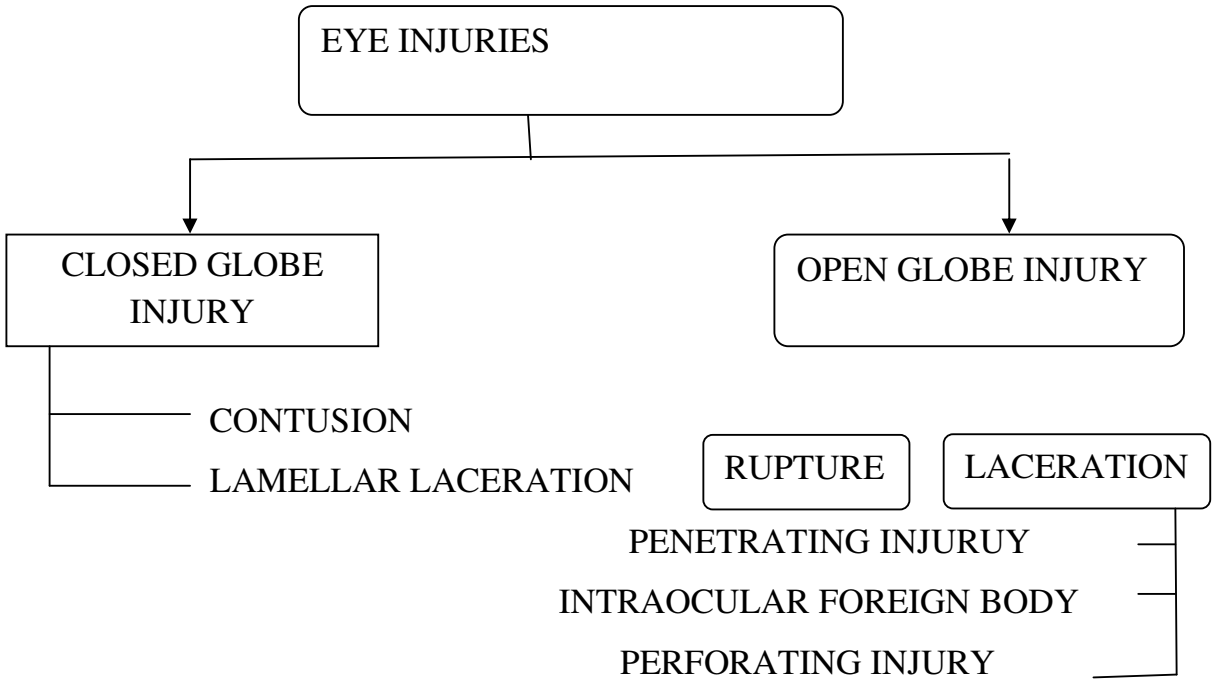
The volume of adult orbit is about 25–30 mL. The globe occupies approximately 7 mL or 25% of the space. The orbit depth which is measured from the center of the orbital margin to the apex is about 45 mm. The globe is at a distance of 4mm from the roof, 4.5mm from the lateral wall, 6.5mm from the medial wall and 6.8mm from the floor.

The lateral walls of the orbit are about90 degrees from one another and run approximately 40–45 mm, whereas the medial walls are parallel to one another. Due to this bony orientation, the eyes tend to diverge, and thus are tonically held in adduction by the medial rectus muscles to achieve a good ocular alignment.(2)



CLASSIFICATION OF OCULAR TRAUMA

1). BETTS CLASSIFICATION



The definitions of these terms according to the New Ocular Trauma Terminology system are

Eyewall	Rigid structures of sclera and cornea
Closed globe injury	Eyewall does not have full thickness wound. No corneal or scleral wound at all (contusion) Partial thickness (lamellar laceration)
Open globe injury	Full thickness wound in eyewall
Rupture	Blunt injury causes full thickness wound of eyewall and hence IOP decreases. Eyewall gives way at its weakest point
Laceration	Full thickness wound due to sharp objects
Penetrating injury	Single laceration of eyewall due to sharp objects. No exit wound
IOFB	Retained IOFB causing entrance laceration
Perforating injury	Two full thickness lacerations of the eyewall (entrance and exit)

2) Classification proposed by Rychwalski et al and Pieramici et al is

OPEN GLOBE CLASSIFICATION:

I. TYPE

A	Rupture
B	Penetrating
C	IOFB
D	Perforating
E	Mixed

II. VISUAL ACUITY:

A	>20/40
B	20/50 to 20/100
C	19/100 to 5/200
D	4/200 to light perception
E	No light perception

III. PUPIL

A	Positive RAPD
B	Negative APD

IV. ZONE

I	Isolated to cornea
II	Corneoscleral limbus to 5mm posterior into the sclera
III	Posterior to anterior 5mm of sclera

OCULAR TRAUMA SCORE

This score is used to predict the visual outcome of the patients following open globe ocular trauma. With this predictive value we can counsel the patients after an open globe injury; its predictive accuracy is around 80%.

METHODS FOR CALCULATING OTS

TABLE 1:

INITIAL VISUAL FACTOR	**RAW POINTS**
Initial raw score (based on initial VA)	>20/40 = 100 20/200- 20/50 = 90 1/200 – 19/200 = 80 PL or HM =70 NPL = 60
Globe rupture	-23
Endophthalmitis	-17
Perforating injury	-14
Retinal detachment	-11
RAPD	-10

TABLE 2:

Probability of follow up visual acuity category at 6 months

Raw Score Sum	OTS Score	NLP	LP/HM	1/200-19/200	20/200 to 20/50	20/40
0-44	1	73%	17%	7%	2%	1%
45-65	2	28%	26%	18%	13%	15%
66-80	3	2%	11%	15%	28%	44%
81-91	4	1%	2%	2%	21%	74%
92-100	5	0%	1%	2%	5%	92%

PROCEDURE TO CALCULATE OTS

1. Assign an initial raw score based on the initial visual acuity
2. From this initial raw score subtract points for each factor as mentioned in table1.
3. Once the raw score sum has been calculated find the relevant category in table 2 and mention the corresponding OTS score.

The OTS score enables us to efficiently plan, manage and monitor the range of ocular injuries due to mechanical trauma.

OCULAR MANIFESTATIONS OF TRAUMA

1.EYELIDS:

Depending on the mechanism of injury, eyelids may display multiple types of injuries.

a) Periorbital edema and ecchymosis:

It is the most common result of blunt injury to the eyelid. Ecchymosis is due to collection of blood in the subcutaneous space and it is purplish red in colour. It may be due to localized causes or also seen in anterior cranial fossa (ACF) fractures.

Ecchymosis due to ACF fracture	**Ecchymosis due to local causes**
Extravasated blood is limited sharply to orbital margin	No limitation
Colour is purplish red	Bluffy red
Hemorrhage does not move with movement of conjunctiva	Hemorrhage moves with movement of conjunctiva

b) Emphysema:

It is the abnormal presence of air in the subcutaneous tissues of the orbit. It is caused due to trauma in the medial wall lamina papyracea or orbital floor. If large amount of air enters the orbit, it may cause an increase in intraorbital

pressure and cause orbital compartment syndrome. Heerfordt described three types of ocular emphysema. They are

TYPE 1 -Palpebral or Preseptal	Intact orbital septum and air is confined only to the eyelids.
TYPE 2- True orbital	Occurs with fracture of bony orbital wall and accumulation of air behind intact septum.
TYPE 3- Orbitopalpebral	Air accumulates within orbit and intraorbital pressure increases

c) Ptosis:

Ptosis due to trauma may occur due to traumatic disinsertion or direct damage to the levator palpebrae superioris aponeurosis, oculomotor nerve palsy or mechanical ptosis due to lid edema.

d) Laceration:

Lid lacerations may be full thickness or partial thickness. Any laceration in the medial canthus should be inspected for the possibility of a canalicular injury.

2. CONJUNCTIVA

A) Subconjunctival hemorrhage:

It is similar to an ordinary bruise on the skin- “it’s like a bruise of the eye”. It is a very common condition that presents as an ocular emergency owing to its dramatic appearance. It appears as a single red spot or scattered red patches on the white of the eye. It is due to blood under the conjunctiva. It is usually painless and does not affect vision. They are very common in trauma because the blood vessels in the conjunctiva are very fragile and can easily bleed. It appears bright red initially and as the hemorrhage starts getting absorbed the colour changes to orange first and then yellow.

Grading of subconjunctival hemorrhage:

GRADE	**QUADRANTS INVOLVED**
I	ONE
II	TWO
III	THREE
IV	FOUR

B) Chemosis:

It is edema of the conjunctiva. It is due to accumulation of exudates in subconjunctival tissues. The conjunctiva appears swollen and gelatinous. It may even protrude between the lids.

C) Conjunctival laceration:

Since the conjunctiva is very thin it gets lacerated due to a direct impact. It may be isolated or part of more severe ocular injuries. It may be associated with chemosis, subconjunctival hemorrhage. Since the conjunctiva is freely mobile, conjunctival laceration is rarely extensive.

3. CORNEA:

Trauma to the cornea is extremely common among children. Corneal injuries may be primary or secondary

PRIMARY	Corneal epithelium damage, corneal laceration, corneal tear
SECONDARY	Edema, blood staining, Descemet's membrane folds

a) Corneal abrasion:

Frequently seen with even minor trauma. It is associated with severe pain and photophobia. It stains with fluorescein and its borders are generally sharp. They usually heal within 24 hours.

b) Recurrent epithelial erosion:

Corneal abrasions may sometimes damage the epithelium- basement membrane complexes and lead to recurrent epithelial defects. It s associated with acute onset of pain, photophobia and lacrimation.

c) Non penetrating corneal lacerations:

Small non perforating corneal injuries usually self seal due to stromal swelling when the stroma is exposed to tears and aqueous fluid after breakdown of epithelial barriers. A Siedel test is done to check for microscopic leaks.

d) Full thickness corneal laceration:

It is a very serious injury and requires immediate treatment to prevent visual loss. It may present with pain, photophobia, lacrimation and defective vision. It may allow aqueous humour to leak from the anterior chamber. Full thickness corneal tear may be associated with iris prolapse, lens distruption, vitreous and uveal prolapse.

e) Blood staining of cornea:

Occurs typically after prolonged hyphema associated with elevated intraocular pressure. Cornea appears reddish brown in colour. The opacification consists of hemosiderin that gets embedded in corneal stroma. Clearing usually starts in the periphery and travels centrally.

4. ANTERIOR CHAMBER(AC):

a) Hyphaema:

Accumulation of blood in the anterior chamber. Following ocular trauma disruption of major arterial circle of iris may occur. Depending on the extent of vascular damage varying amount of blood enters the anterior chamber. It may cause obstruction of trabecular meshwork by blood clot or by inflammatory debris leading to increase in intra ocular pressure.

Grading of hyphaema:

Grade 1	Hyphaema less than 1/3rd of AC
Grade 2	Hyphaema between 1/3 to ½ of AC
Grade 3	More than ½ of AC but less than complete filling of AC
Grade 4	Total hyphaema

b) Angle recession:

It is a sequelae of blunt ocular trauma and it is characterized by separation of circular and longitudinal fibres of ciliary muscle. It is often masked initially due to the presence of concomitant hyphaema. Those with less than 180 degree of recession rarely develop glaucoma. However those with 180 degree or more of recession will eventually develop late glaucoma.

5. IRIS AND CILIARY BODY

a) Iridodialysis:

It is the separation of iris from ciliary body at the iris root. The pupil often takes a D shaped configuration. Small iridodialysis may appear as small black area in the periphery of anterior chamber. Sometimes large dialysis may cause severe distruption of normal iris architecture.

b) Traumatic iritis

Ocular trauma leads to hyper permeability of vessels. This in turn leads to leakage of protein and fibrin into the anterior chamber leading to iritis. Presents with pain, redness, photophobia and on slit lamp examination anterior chamber

cells and flare will be present. Ciliary body inflammation leads to hypoproduction of aqueous and leads to lowering of intraocular pressure. Elevated intra ocular pressure may also be seen in case of traumatic iritis. Treated with corticosteroids and cycloplegics.

c) Traumatic aniridia:

Sometimes the injury may be so severe such that the iris is completely torn from the ciliary body and sink in the bottom of anterior chamber.

d) Cyclodialysis:

It is the detachment of ciliary body from the sclera spur and this allows free passage of aqueous into the suprachoroidal space. This is characterised by severe hypotony. Associated corneal edema, shallow anterior chamber, peaked pupil near the cyclodialysis site may be present.

6. PUPIL:

a) Traumatic miosis and mydriasis:

Traumatic mydriasis is more common than miosis. Mydriasis is associated with iris sphincter tears and miosis is associated with anterior chamber inflammation.

b) Sphincter tear:

The pupil margin may appear serrated or irregular following iris sphincter tear. The pupil usually is in mid dilated position.

7.LENS:

Lens injuries are common in eyes sustaining significant trauma. Lens injuries are of various types. They are

a) Subluxation and dislocation:

A lens with zonular weakness can change its position depending upon the postural change of the patient. If zonular dehiscense is incomplete the lens is drawn away from the site of rupture of zonules by the intact zonules. In this case the anterior chamber will be deep. If there is previous history of surgeries like ECCE or penetrating keratoplasty the lens may be extruded through the wound. Posterior dislocation of lens will cause severe vision loss since the person becomes aphakic. Lens may also be dislocated into the anterior chamber.

b) Vossius ring:

It is a complete or incomplete deposition of iris pigment over the anterior lens capsule. It is due to compression of pigmented posterior iris epithelial cells against the anterior lens capsule following blunt injury.

c) Traumatic cataract:

It may occur immediately or years after blunt trauma. Following trauma disruption of lens capsule occur which allows aqueous humour to enter the lens leading to opacity and cataract formation. The various types of traumatic cataract are

- Rosette cataract
- Traumatic zonular cataract

- Diffuse concussion cataract
- Sub epithelial opacities

8.VITREOUS

Vitreous can be injured in blunt trauma by disinsertion or opacification.

a) Vitreous disinsertion:

Disinsertion occurs at the vitreous base, optic nerve, retinal vessels, fovea or chorioretinal scars. The avulsed vitreous base has the appearance of a ribbon suspended loosely through the vitreous cavity.

b) Vitreous opacification:

Occurs after hemorrhage from torn retinal, choroidal or ciliary body vessels. Release of pigments from retinal pigment epithelial cells and iris may also lead to vitreous opacification. Pigment in the vitreous is an indication of an underlying retinal tear or dialysis.

c) Vitreous hemorrhage:

Patient presents with symptoms of sudden floaters and reduced vision. The most common cause of vitreous hemorrhage associated with trauma are posterior vitreous detachment, retinal tear, retinal detachment. Acute hemorrhage appears red with distinct borders. The blood then diffuses throughout the vitreous within a week after the initial hemorrhage. As blood cells are phagocytosed and hemoglobin is broken down the hemorrhage

acquires a yellow brown colour as early as 10 days. Non clearing vitreous hemorrhage may cause secondary complications like glaucoma, hemosiderosis and proliferative vitreoretinopathy.

Grading of resolving vitreous hemorrhage:

Grade 1	Opaque vitreous
Grade 2	Only red reflex seen, other details not visible
Grade 3	Patches of fundus seen in between opacities
Grade 4	Central vitreous is clear
Grade 5	Clear vitreous

d) Vitreous loss:

This condition is seen in open globe injuries

e) Vitreous detachment:

It is the separation of cortical vitreous from retina anywhere posterior to vitreous base. It may be associated with vitreous hemorrhage, retinal hemorrhage or retinal dialysis.

9.RETINA:

a) Commotio retinae:

Also known as Berlin's edema. It is the most common retinal manifestation of contusive ocular injury. Characterised by whitish grey appearance of the retina sometimes accompanied by intraretinal hemorrhage, choroidal or retinal pigment epithelial deatachment. It may be observed in the retinal periphery or in the posterior pole. It is visually significant when it involves the macula. After resolution of the retinal edema, retinal pigment epithelial irregularity and its migration into the retina may produce a retinitis pigmentosa like appearance. There is no effective treatment for commotio retinae.

b) Contusion of retinal pigment epithelium:

Blunt trauma to the eye sometimes may lead to injury to the retinal pigment epithelium. It may be associated with serous retinal detachment or retinal pigment epithelial cell edema. No effective treatment is known.

c) Traumatic retinal vascular occlusion:

Generalised retinal vascular constriction or occlusion of central retinal artery or vein may be seen rarely after a blunt trauma. It may be due to generalized arteriospasm secondary to blunt trauma and shearing of central retinal vessels in the optic nerve secondary to extreme traumatic rotation of the globe.

d) Traumatic macular hole:

The fovea lacks structural support from the inner retinal layers and is avascular. Injury to the eye may cause a full thickness macular hole at the time of impact. Surface traction at the vitreoretinal interface during trauma initiates hole formation.

e) Retinal dialysis:

Disinsertion of retina from the nonpigmented pars plana epithelium at the ora serrata. However it remains attached to the vitreous base. It leads to 7 % of retinal detachment. It is most commonly located in the inferotemporal quadrant.

f) Retinal tears:

Areas of strong vitreoretinal adhesion cause retinal breaks during traumatic or spontaneous vitreous detachment. If the break extends for atleast 90 degrees or 3 clock hours, it is known as giant retinal tear.

g) Necrotic retinal breaks:

Direct contusive trauma may cause retinal necrosis or ischemia at the site of impact. Detachment associated with necrotic retinal break occurs early within 24hours.

h) Traumatic retinal detachment:

Commonest type of trauma responsible for detachment are blunt injuries. The force of the injury is an important factor which determines the extent of damage. Persons with high myopia are at increased risk. Retinal detachment following trauma is usually total and most commonly involves the macula. It

may occur immediately after injury or delayed following contraction of the organized vitreous hemorrhage.

10. CHOROID:

a) Choroidal hemorrhage:

Traumatic choroidal hemorrhage occurs when blood accumulates between choroid and sclera. Hemorrhage occurs due to rupture of long and short posterior ciliary arteries and veins. It is located most frequently at the equator or adjacent to the disc.

b) Choroidal detachment:

Similar to choroidal hemorrhage, detachments occur due to accumulation of blood between choroid and sclera. The choroid is well attached to the vortex veins and hence choroidal detachments have a dome shaped appearance. Usually found in the temporal aspect of the injured globe.

c) Choroidal rupture:

It is a traumatic break in the retinal pigment epithelium, bruch's membrane and underlying choroid. They are crescent shaped with tapering ends.

Direct choroidal rupture	• Occurs at the site of impact • Large and irregular in shape
Indirect rupture	• Away from the site of injury • Present within posterior pole

11. SCLERA:

a) Scleral rupture:

Direct rupture occurs at the site of impact. Indirect rupture occurs at the site of scleral weakness. Most scleral ruptures are solitary but multiple ruptures may occur in severe cases. Eyes with scleral rupture have more chances for developing intraocular bacterial contamination.

12. INTRAOCULAR PRESSURE:

If a known open globe injury is present IOP measurement should be deferred. Intraocular pressure may be high or low

CAUSES OF HIGH IOP	CAUSES OF LOW IOP
Hyphema Hemolytic glaucoma Angle recession glaucoma Anterior chamber inflammation Epithelial downgrowth Retrobulbar hemorrhage	Wound leak Retinal detachment Ciliochoroidal detachment Ciliary body ischemia

13. OPTIC NERVE INJURY:

(i) Prelaminar injury - presents with disc swelling and peripapillary hemorrhage. It leads to optic atrophy and severe loss of vision.

(ii) Laminar injury- it occurs due to sudden elevation in intraocular pressure due to blunt trauma and leads to rupture of lamina cribrosa and optic nerve avulsion. Vision loss is permanent and profound.

(iii)Post laminar injury – accompanied by optic disc swelling and evidence of orbital or ocular injury.

14. OTHER CRANIAL NERVES

a) Oculomotor nerve:

The mechanism of injury of oculomotor nerve due to trauma most commonly involves at the level of posterior clinoid ligament.

b) Trochlear nerve:

Involvement of trochlear nerve may lead to diplopia on looking down and to the opposite side.

c) Abducent nerve:

Isolated abducent nerve palsy may occur due to trauma or raised intracranial tension or fracture at the base of the skull.

d) Facial nerve:

Usually involved in head trauma. Patient complaints of immobility of entire half of face and inability to close the lids.

15. ORBITAL TRAUMA

It is commonly seen in children who suffer head and face trauma in RTA. Compared to adult orbit the orbit of children are more elastic. Orbital fracture is classified as:

TYPE I	Fracture of orbital rim
TYPE II	Fracture of orbital wall with no functional impairment
TYPE IIIa	Fracture of orbital wall with diplopia (adults)
TYPE IIIb	Fracture of orbital wall with diplopia (children)
TYPE IV	Fracture with open wound or penetrating injury
TYPE V	Fracture of orbital apex or compression of globe or ischemia to optic nerve

Type I and II can be treated prophylactically since it is not an emergency. Type III should be treated within few days in children. Type IV should be treated within 24hours whereas type V requires immediate treatment.

RETAINED INTRAOCULAR FOREIGN BODY

Ocular foreign bodies can be inert but often causes serious complications in the eye and hence should be examined and removed properly. The damage caused by the foreign body depends upon the size, shape, nature of the foreign body and the force of entry into the eye. Infectious endophthalmitis is an uncommon but potentially dangerous complication of penetrating ocular injury with retained intraocular foreign body. The foreign body may be present either extraocularly or intraocularly. Now according to new classification foreign body within the coats of the eyeball is known as Intramural foreign body (IMFB)

1.EXTRAOCULAR FOREIGN BODY:

It involves lid, sclera, conjunctiva and cornea. Usually foreign bodies that cause extraocular injuries are dust, sand, iron particles, wings of insects etc. If the foreign body is not eliminated by tears, it incapacitates the patient and any introduction of infection may cause permanent damage to vision.

In the **conjunctiva**, particularly those in the subtarsal fold may continuously abrade the cornea during blinking.

In the **cornea** the FB produces profuse watering, redness. Visual acuity is reduced when the FB is embedded in the center of the cornea. In the **sclera** FB impaction is rare and is usually found in the palpebral aperture.

2.INTRAOCULAR FOREIGN BODY:

Usually seen in the angle of anterior chamber, iris, lens, vitreous and retina. The IOFB that penetrates the eye are chips of iron, steel, stone, glass, lead particles, copper, wood, etc. if the velocity is great the FB may traverse the eye causing a double perforation and gets lodged in the orbital tissues.

- **FB in the anterior chamber**: It rests in the bottom of AC. Sometimes it may be so small so that it can be visualized only in gonioscopy. If iris gets torn exudates are seen in the tissues.
- **FB in lens**: FB usually rests in the nucleus. The effect in the crystalline lens varies form localized opacity to opacification of entire nucleus.
- **FB in posterior segment**: may enter through cornea, iris, lens, zonules or through the sclera. The foreign body may traverse the vitreous and bury in the posterior wall of the globe.

EFFECT OF RETAINED FOREIGN BODIES

The effect or reaction depends upon the composition of the particle. There are three type of effects

No specific reaction	Inorganic substances
Non specific or occasionally specific	Chemical reaction
Proliferative response	Organic material

INERT SUBSTANCES:

Metals like gold, silver, platinum, lead, etc. These don't elicit reaction in the anterior chamber but in the posterior chamber they may cause liquefaction, opacification of vitreous gel.

MERCURY:

- Causes purulent inflammation

COPPER:

- In its pure state the reaction is catastrophic. Causes acute iritis with hypopyon, retinal degeneration, papillitis and rapid pthisis.
- 'Chalcosis' occurs when a copper containing IOFB deposits copper in Descement's membrane, anterior lens capsule or other intraocular basement membranes.
- Greenish brown KAYSER FLEISCHER RING in the peripheral cornea.
- Sunflower cataract in the anterior lens
- Impregnation of zonular fibres
- Appearance of metallic particle in aqueous humor
- Greenish discolouration of iris
- Highly refractive deposit on the surface of retina.

IRON:

- After iron deposition in ocular tissues it appears as a brown deposit known as ‘rust ring’.
- The chemical effects of iron on the ocular tissues in known as ‘siderosis’. It is of two types direct and indirect siderosis

DIRECT	Iron is deposited in the neighborhood of the foreign body
INDIRECT	The metal is distributed widely throughout the ocular tissues producing a condition which leads to blindness

LEAD:

It is an irritant. But in the eye it acts as an inert substance because it is covered by insoluble carbonate in the eye which prevents lead from diffusing and thereby its chemical reaction.

VEGETABLE MATERIAL:

These are the commonest cause of infective corneal ulcers. Wood is the commonest IOFB of vegetable nature. If the wood particle is infected it causes

acute pyogenic inflammation which leads to localized abscess and thereby leading to endophthalmitis or fulminating panophthalmitis.

ADNEXAL FOREIGN BODIES:

1) FB in the lids – can be present on the surface of the lids or within its substance

2) FB in the orbit- can be present in the muscle cone or in the peripheral spaces

3) FB in lacrimal passages- Foreign body may be present in the substance of the lacrimal gland, in the lacrimal sac or in the nasolacrimal canal

PART II

AIMS AND OBJECTIVES

AIMS AND OBJECTIVES

I. To Identify the causes,demographic and clinical profile of ocular injuries in school going children

II. To evaluate the final visual outcome

III. To explore the possibilities of prevention of visual loss

INCLUSION CRITERIA: 5-18 years

Boys and girls

Unilateral and bilateral

All mode of injuries

Presenting for the first time

One eyed

EXCLUSION CRITERIA : Less than 5years

More than 18years

Pre-existing ocular morbidity

Congenital anomalies

MATERIALS AND METHODS

MATERIALS AND METHODS

School going children of the age group 5- 18 years who presented with ocular trauma to the Department of Ophthalmology, Thanjavur medical college, Thanjavur from December 2015 to August 2017 were taken up for this study.

A prospective and analytical study of 120 children who presented to our hospital with history of ocular trauma was done. Detailed work up was done of the patients with ocular trauma, which included a detailed trauma history. History of pre existing ocular and medical disease was also recorded.

A proforma was drawn up and following details were recorded for each patient with ocular trauma: age, sex, signs and symptoms following the injury. Ocular examination in this study included:

- Visual acuity by Snellen's chart.
- Slit lamp examination
- Intraocular pressure with Schiotz or Applanation tonometer, whenever possible
- Direct ophthalmoscopy was performed in all cases
- Gonioscopy, if required
- Indirect ophthalmoscopy
- Radiological investigations when required

- B scan ultrasonography in patients suspected to have posterior segment abnormality with or without media opacities
- CT or MRI scan whenever required

Patients with minor injuries were treated as outpatients and those with complications were admitted as inpatients and treated. All patients were called for follow up 1 week after being discharged from the hospital. Patients were followed up weekly for a month and then monthly once for a period of one year depending upon the severity of the injury . Whenever it was necessary patients were referred to higher centre.

CLINICAL PROCEDURES AND INVESTIGATIONS

1) VISUAL ACUITY:

Vision was tested using Snellen's visual acuity chart.

2) INDIRECT OPHTHALMOSCOPY:

In this study The Keeler binocular indirect ophthalmoscope with the lens strength of + 20 D was used.

Patient's were examined with pupils fully dilated and in the supine position in a dark room. Scleral indendation was done to view the retinal periphery and ora serrata.

3) DIRECT OPHTHALMOSCOPY:

All the patients were examined with direct ophthalmoscope in this study.

4) GONIOSCOPY:

In this study Goldmann three mirror gonioscope was used to view the angle structures.

5) B-SCAN ULTRASOUND:

B-scan contact method was performed. In contact technique, the ultrasonic probe is held directly against the closed lids. The ultrasonic probe used was 10 Mega hertz. It is used for localization of ocular foreign bodies in relation to the ocular coats.

6) X-RAYS:

Plain x-rays are used in suspected case of fractures and are also used to localize intraocular foreign bodies.

7) CT – Computed tomography

CT Scan is important in case of orbital trauma for detecting any fractures in the orbital wall, to locate any intraocular foreign body, to look for any herniation of extra ocular muscles and orbital fat. Sagittal view is important in evaluating blow out fractures of the orbital floor.

OBSERVATION AND RESULTS

OBSERVATION AND RESULTS

Table 1. AGE DISTRIBUTION

AGE IN YEARS	NUMBER	PERCENTAGE
5-10	31	25.8
11-15	63	52.5
16-18	26	21.6

In this study of 120 children, the youngest patient was 5 years old and the oldest was 18 years old. Maximum of 63 cases were recorded in the age group of 11 – 15 years (52.5%), followed by 31 cases in 5- 10 years (25.8%) and 26 cases in 16- 18 years(21.6%).

Fig 1: Age distribution

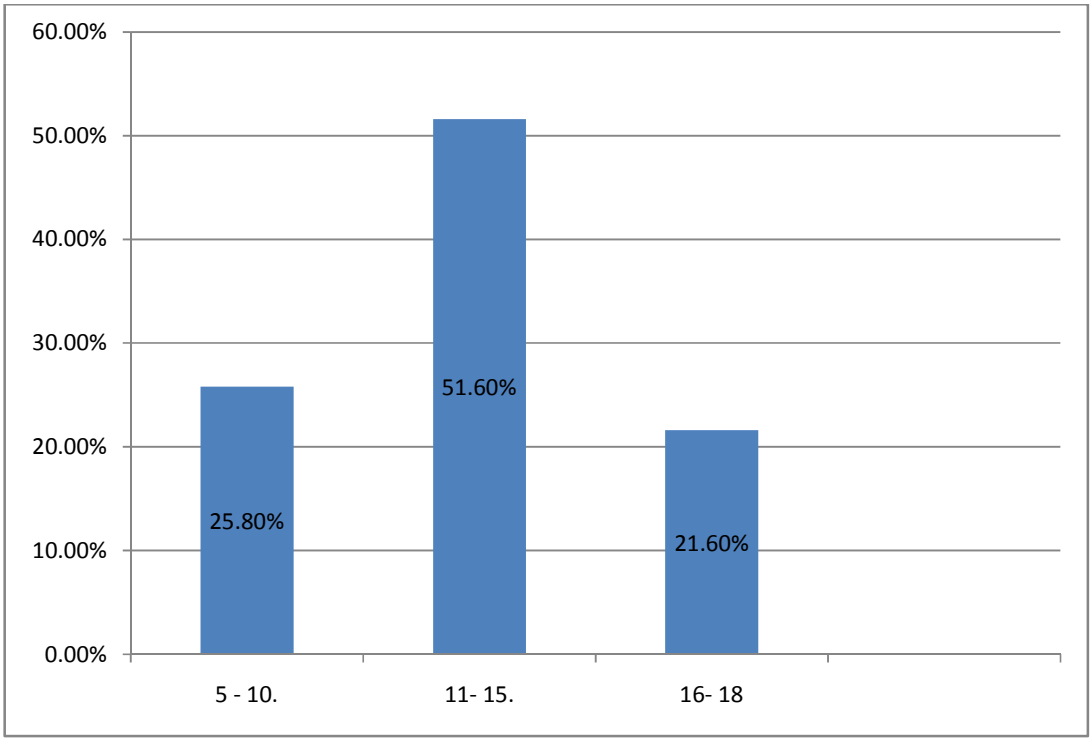


Table 2. SEX DISTRIBUTION

SEX	NUMBER	PERCENTAGE
BOYS	98	81.6
GIRLS	22	18.3

Out of the 120 children, 98 were boys (81.6%) and 22 were girls (18.3%). The male female ratio being 9:2.

Figure 2: Sex distribution

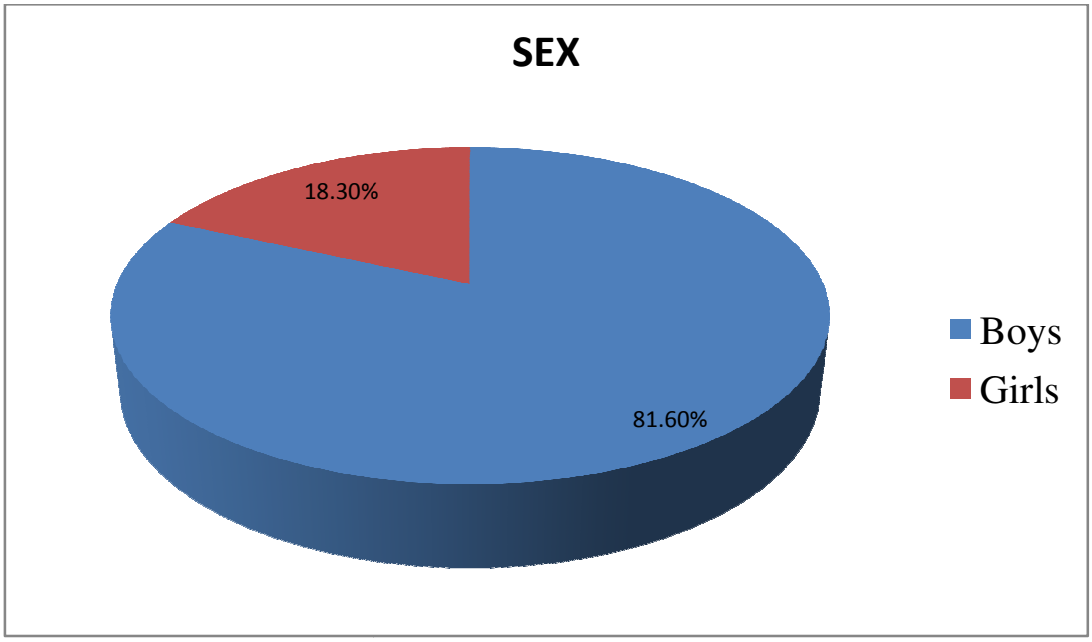


Table 3. MODE OF INJURY

MODE OF INJURY	NUMBER	PERCENTAGE
Accidental fall	35	29.1
Stick	22	18.3
Ball	10	8.3
Hand	18	15.0
Thorn	8	6.6
RTA	17	14.1
Others	10	8.3

Of the 120 cases Accidental injury was the most common cause of injury. 35 cases was recorded(29.1%). This was followed by stick injury- 22 cases(18.3%). 10 cases recorded injury with ball (8.3%), 18 cases with injury by hand(15%), 8 cases presented with injury by thorn (6.6%), RTA 17 cases (14.1%) and 10 were due to other causes like cracker burst, battery burst, burns, injury with iron rod (8.3%).

Figure 3: Mode of injury

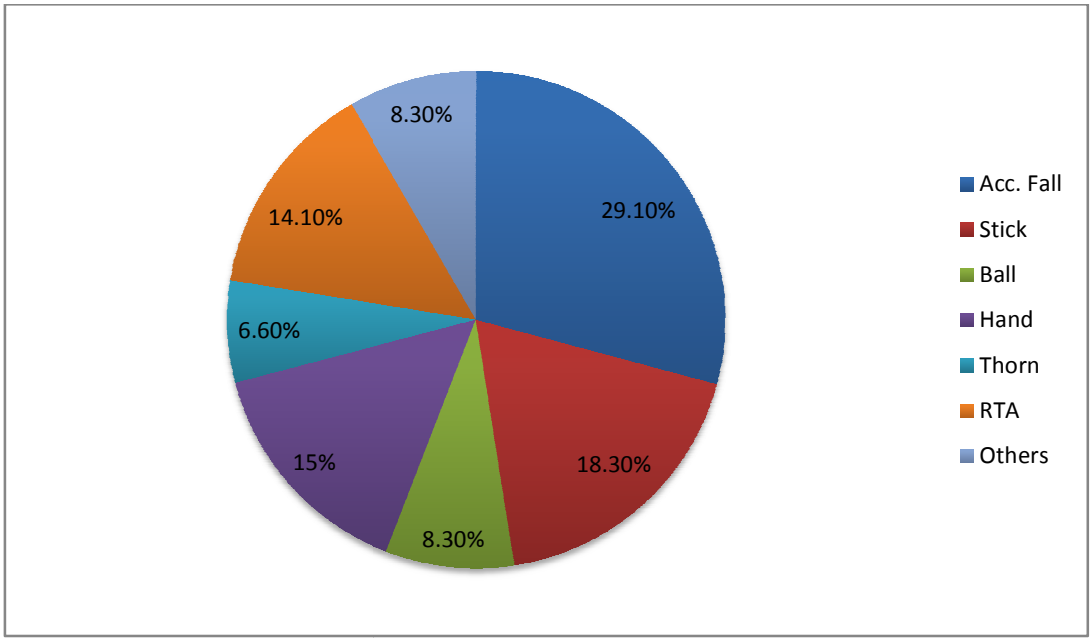


Table 4: MODE OF INJURY IN RTA

MOI	NUMBER	PERCENTAGE
BICYCLE	8	47.1
BIKE	3	17.6
PEDESTRIANS	6	35.2

Out of the 17 children involved in road traffic accidents, 8 were riding bicycle (47.1%), 3 were riding motorbike (17.6%) and the remaining 6 were pedestrians (35.2%).

Figure 4: Mode of Injury in RTA

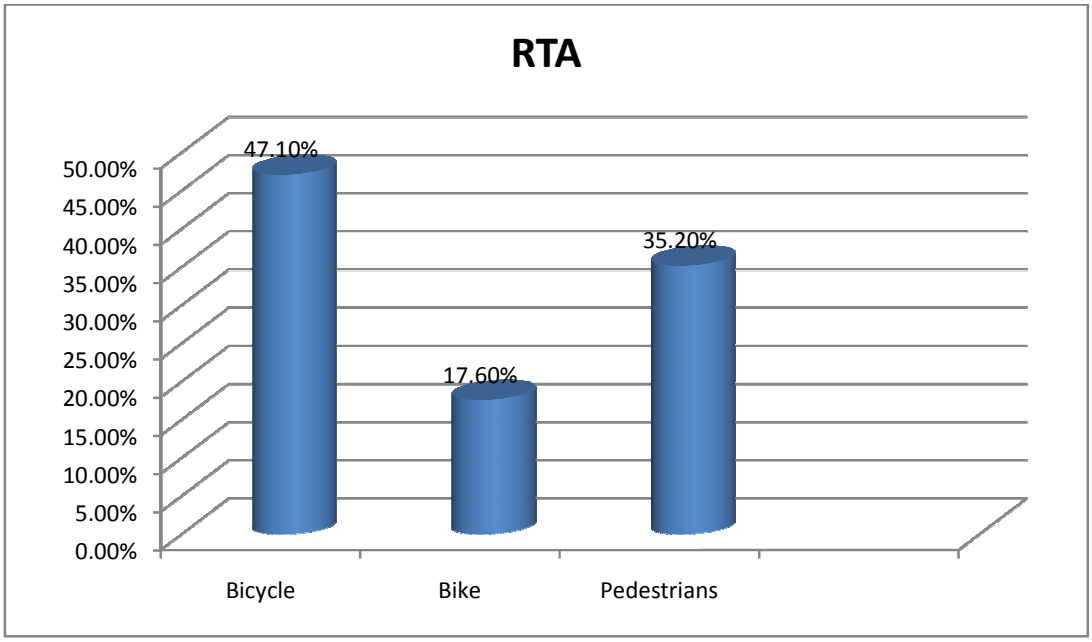


Table 5. EYE INVOLVED

EYE	NUMBER	PERCENTAGE
RIGHT EYE	56	46.6
LEFT EYE	56	46.6
BOTH EYES	8	6.6

Of the 120 cases right eye was involved in 56 children (46.6%), left eye in 56 children (46.6%) and bilateral involvement was seen in 8 children (6.6%).

Figure 5: Eye involved

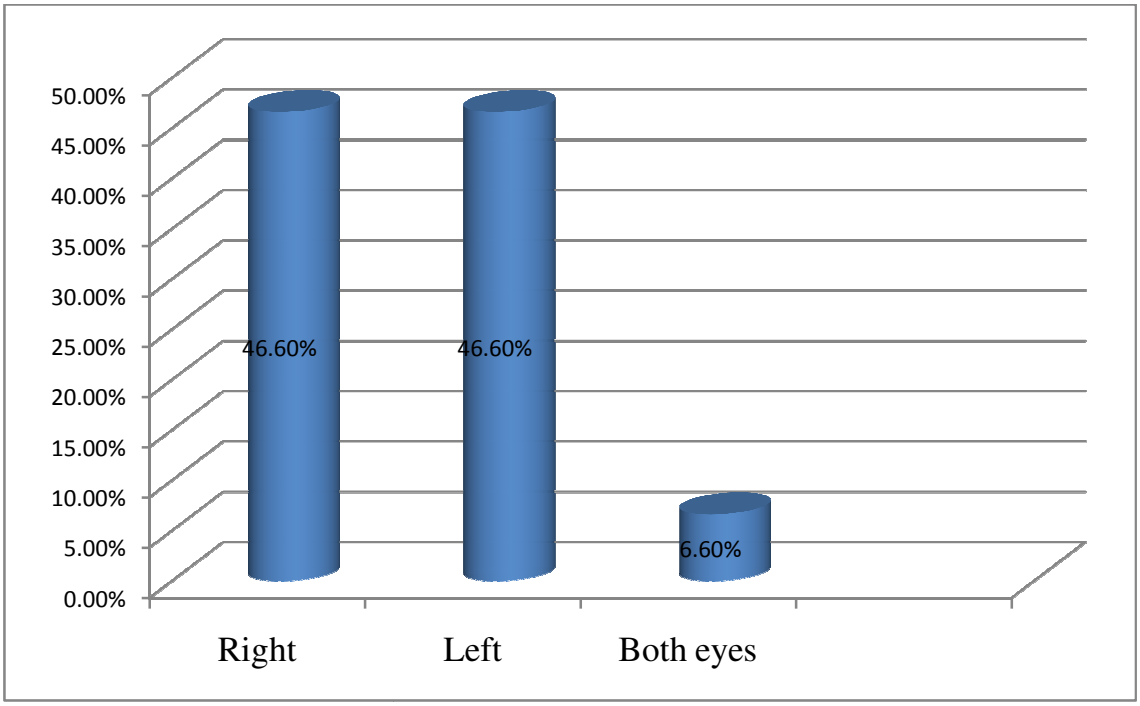


Table 6. OCULAR INVOLVEMENT

Ocular involvement	Number	Percentage
Lids	106	88.3
Conjunctiva	97	80.3
Cornea	21	17.5
Sclera	4	3.3
Anterior chamber	17	14.1
Pupil	23	19.1
Lens	2	1.6
Posterior segment	6	5
Cranial nerves	9	7.5
Orbital wall	14	11.6

Of the 120 patients, orbital wall was involved in 14 cases, lids in 106 patients, conjunctiva in 97 cases, cornea in 21 cases, sclera in 4 patients, anterior chamber in 17 cases, pupil and iris in 23 cases, lens in 2 cases, posterior segment in 6 cases and cranial nerves in 9 cases.

Figure 6: Ocular involvement

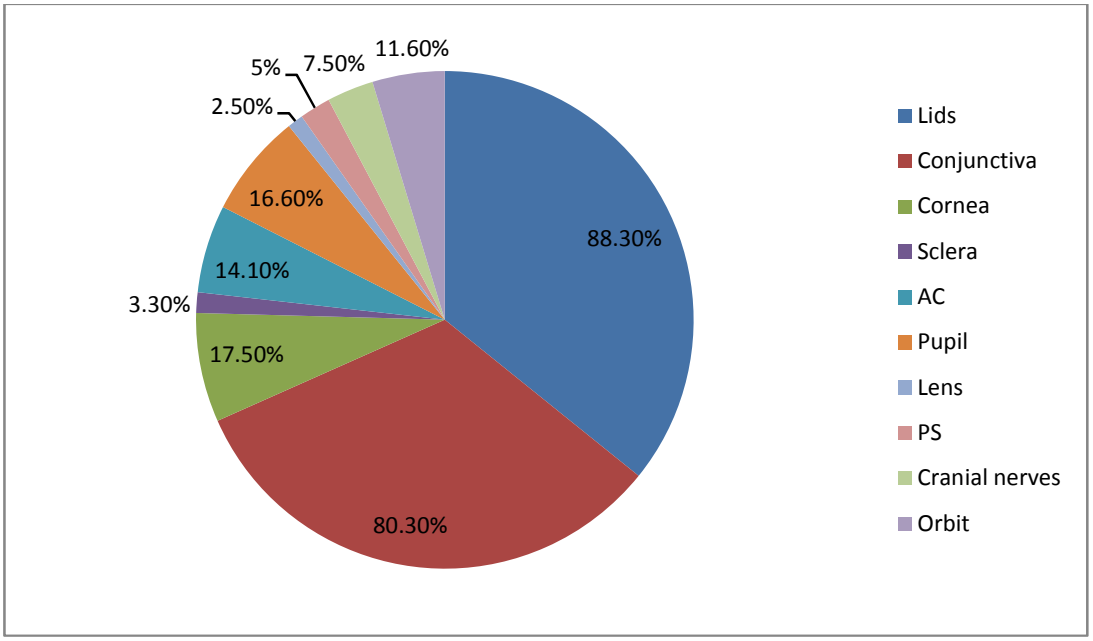


Table 7. LIDS

LIDS	NUMBER	PERCENTAGE
EDEMA	90	75
ECCHYMOSIS	94	78.3
TEAR	5	4.1

In this study, of the 120 cases 90 had periorbital edema (75%), 94 had periorbital ecchymosis (78.3%), lid tear was seen in 5 patients (4.1%).

Figure 7: Lid involvement

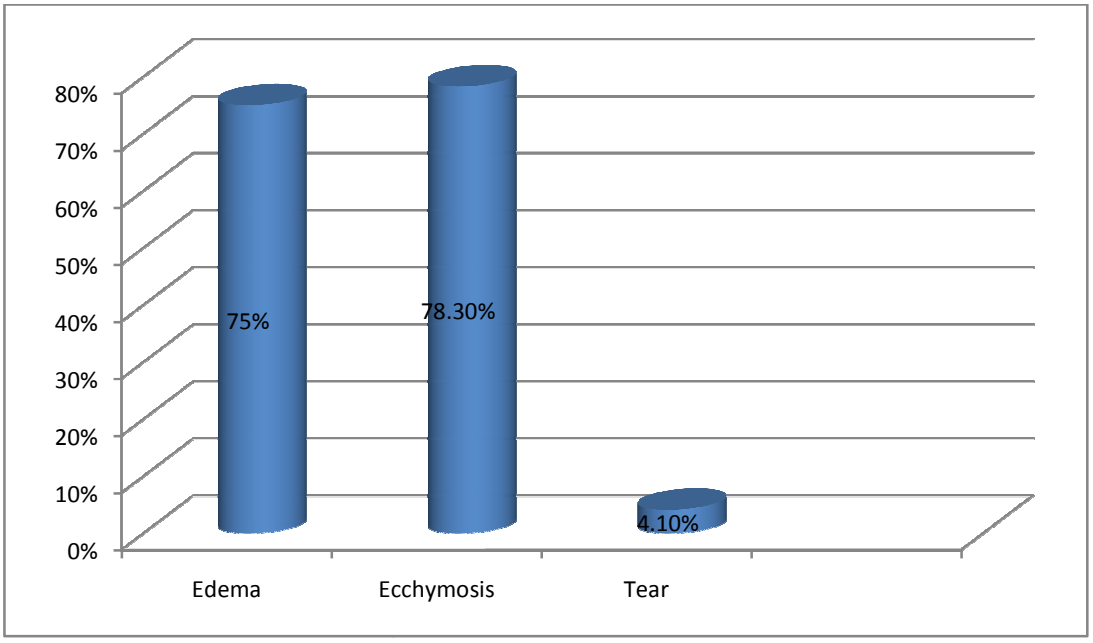


Table 8. CONJUNCTIVA

CONJUNCTIVA	NUMBER	PERCENTAGE
CONGESTION	10	8.3
CHEMOSIS	2	1.6
SCH	80	66.6
TEAR	5	4.1

Out of the 120 patients, 10 had conjunctival congestion (8.3%), chemosis was seen in 2 patients(1.6%), subconjunctival hemorrhage in 80 patients(66.6%), conjunctival tear was seen in 5 patients (4.1%).

Figure 8: Conjunctiva

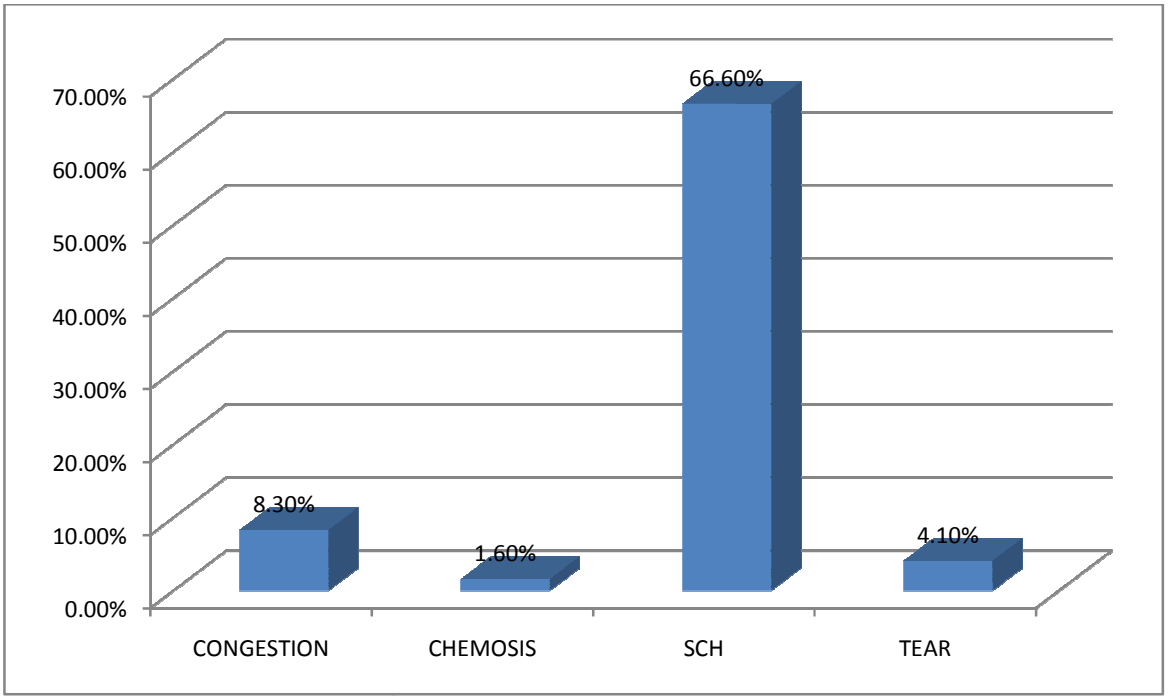
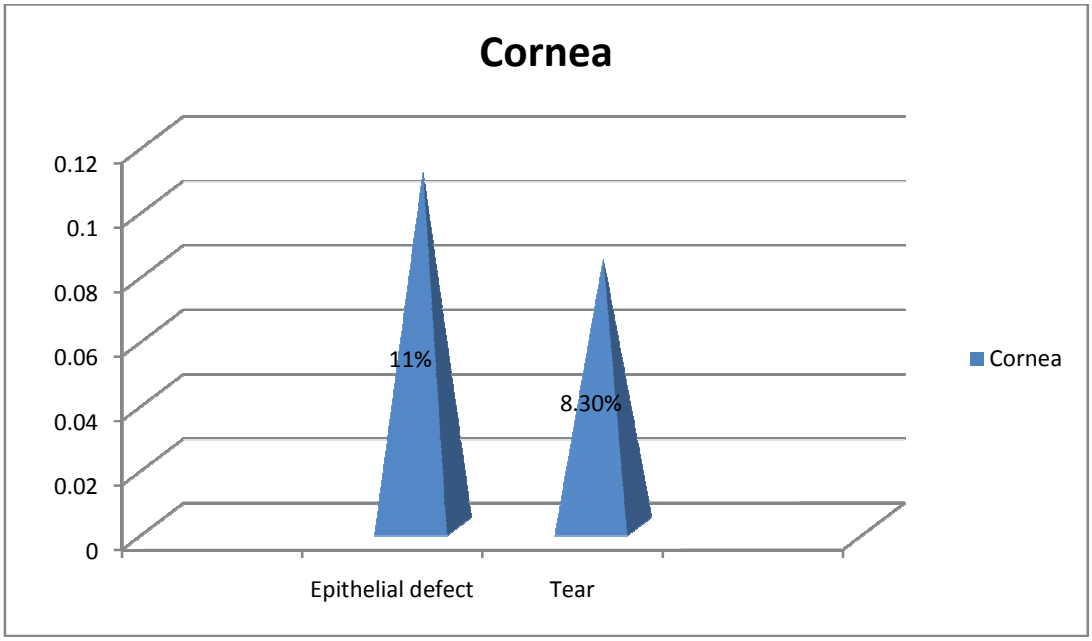


Table 9. CORNEA

CORNEA	NUMBER	PERCENTAGE
EPITHELIAL DEFECT	11	9.1
TEAR	10	8.3

Out of the 120 children, 11 had epithelial defect (9.1%), corneal tear in 10 cases (8.3%).

Figure 9: Cornea



10. SCLERA

SCLERA	NUMBER	PERCENTAGE
TEAR	4	3.3

Out of the 120 patients scleral tear was seen in 4 patients (3.3%).

Table 11. ANTERIOR CHAMBER

ANTERIOR CHAMBER	NUMBER	PERCENTAGE
HYPHAEMA	3	2.5
REACTION	6	5
VARIABLE DEPTH	8	6.6

Of the 120 children, 3 had hyphaema in anterior chamber (2.5%) ,6 had anterior chamber reaction (5%) and 8 children had variable anterior chamber depth (6.6%)

Figure 10: Anterior chamber

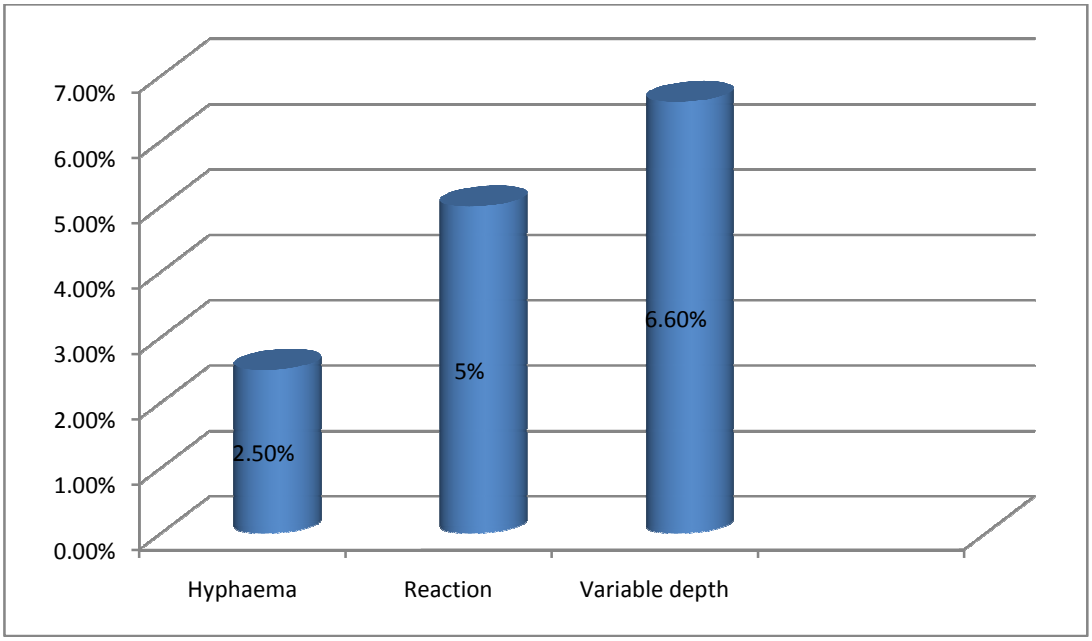


Table 12. PUPIL/IRIS

PUPIL/IRIS	NUMBER	PERCENTAGE
RAPD	8	6.6
IRIS PROLAPSE	6	5
TRAUMATIC MYDRIASIS	3	2.5
IRITIS	6	5

In this study of 120 children 8 had relative afferent pupillary defect (6.6%) , about 6 had iris prolapse (5%), 3 had traumatic mydriasis (2.5%) and 6 children had iritis (5%).

Figure 11: Pupil/ Iris

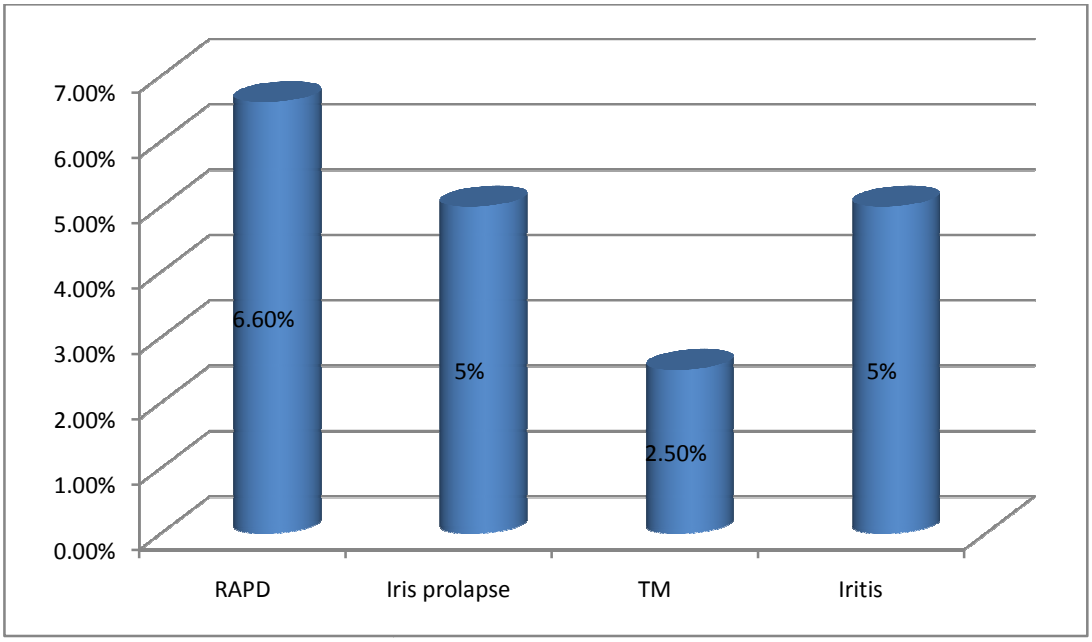


Table 12. LENS

LENS	NUMBER	PERCENTAGE
TRAUMATIC CATARACT	2	1.6

2 children had traumatic cataract (1.6%) among the 120 cases.

Table 13. POSTERIOR SEGMENT

POSTERIOR SEGMENT	NUMBER	PERCENTAGE
MACULAR EDEMA	6	5

Macular edema was seen in 6 cases (5%) out of the 120 cases.

Table 14. CRANIAL NERVES

CRANIAL NERVES	NUMBER	PERCENTAGE
OPTIC NERVE	9	7.5

Out of the 120 cases about 9 had injury to the optic nerve (7.5%).

Table 15: ORBIT

ORBITAL WALL	NUMBER	PERCENTAGE
ROOF	5	4.1
LATERAL WALL	7	5.8
FLOOR	2	1.6

Out of the 120 cases 5 had fracture of the orbital roof (4.1%), lateral wall fracture was seen in 7 cases (5.8%) and floor fracture in 2 cases (1.6%).

Figure 12 : Orbital wall

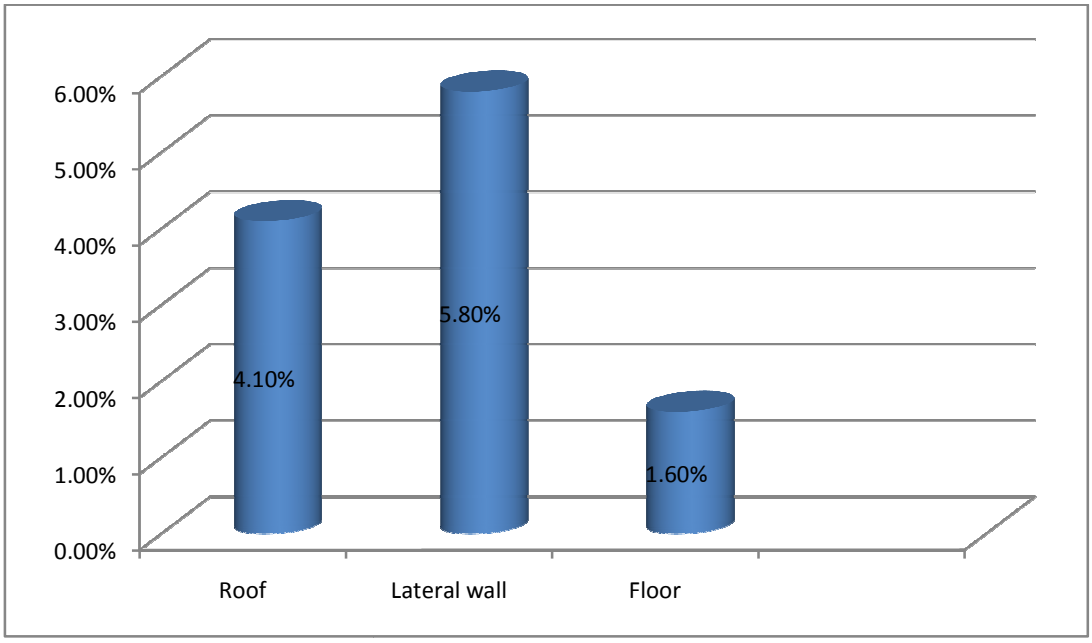


Table 16: TYPE OF INJURY

TYPE OF INJURY	NUMBER	PERCENTAGE
OPEN GLOBE	14	11.6
CLOSED GLOBE	106	88.3

Out of the 120 children, 11.6% had open globe injuries and the remaining 88.3% had closed globe injuries.

Figure 13: Type of injury

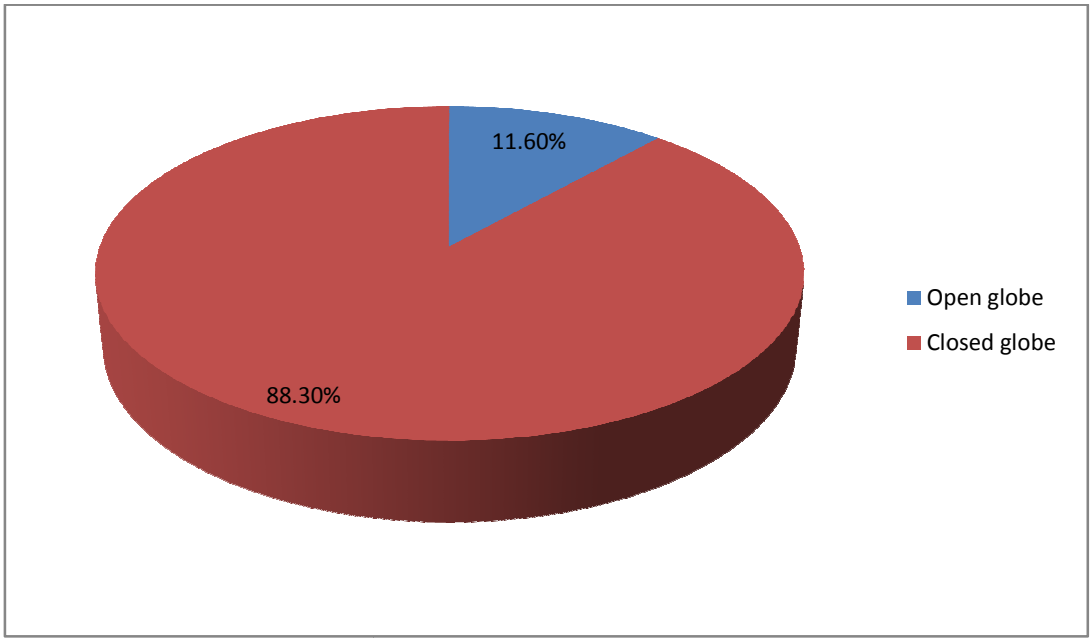


Table 17. VISION AT PRESENTATION

Vision at presentation	**NUMBER**	**PERCENTAGE**
6/6	35	29.1
6/9 – 6/12	43	35.8
6/18 – 6/36	15	12.5
6/60 – 1/60	12	10
CFCF	2	1.6
PL Present	11	9.1
NO PL	2	1.6

Out of the 120 cases 35 patients presented with visual acuity of 6/6(29.1%), 43 had between 6/9-6/12(35.8%), 15 had between 6/18-6/36(12.5%), 12 had between 6/60 – 1/60 (10%), 2 had CFCF (1.6%), 11 had PL (9.1%) and 2 had no PL (1.6%).

Figure 14 : Vision at presentation

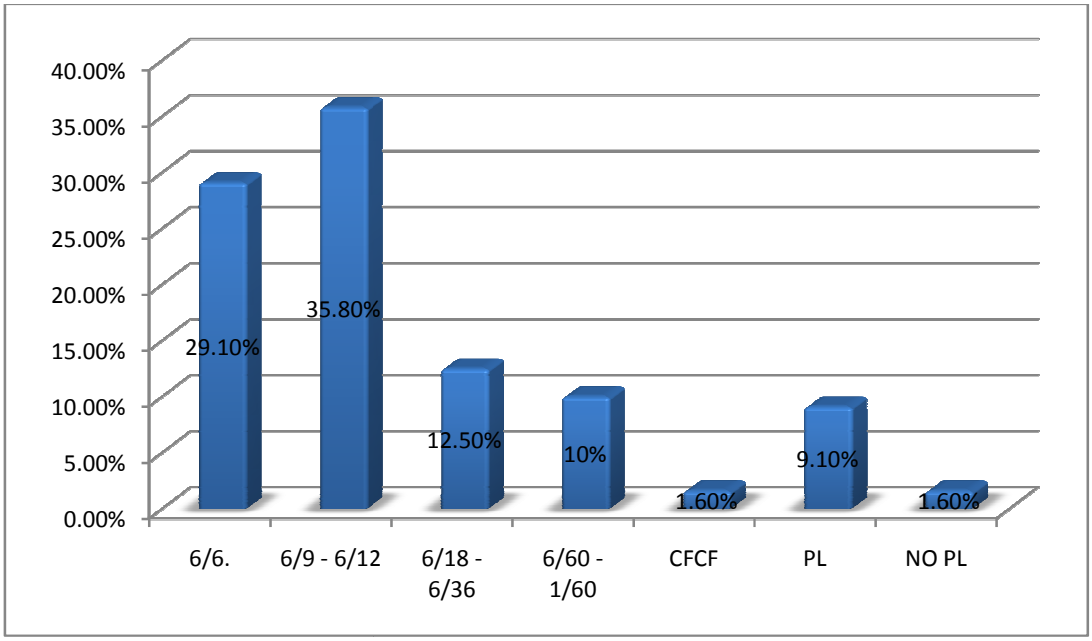
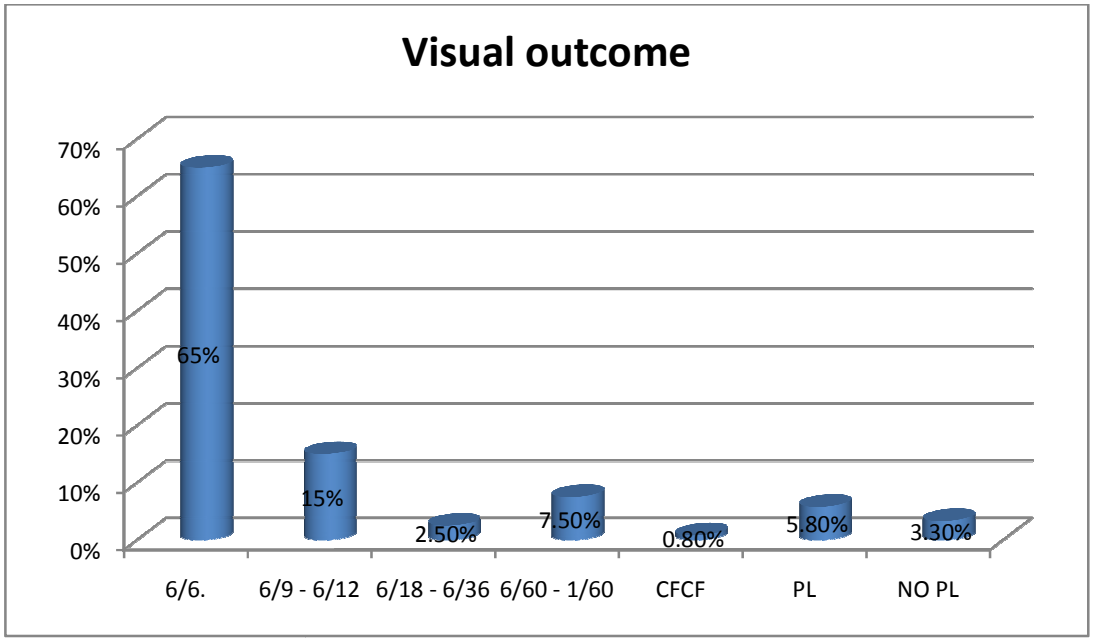


Table 18.VISUAL OUTCOME

VISION OUTCOME	NUMBER	PERCENTAGE
6/6	78	65
6/9 – 6/12	18	15
6/18 – 6/36	3	2.5
6/60 – 1/60	9	7.5
CFCF	1	0.8
PL Present	7	5.8
NO PL	4	3.3

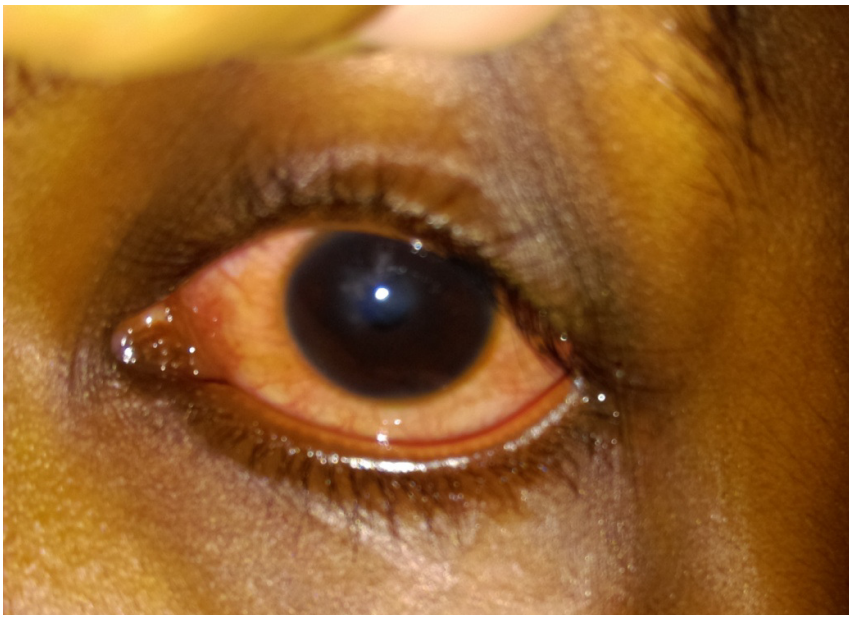
Out of the 120 cases finally 78 had visual acuity of 6/6(65%), 18 between 6/9-6/12(15%), 3 had between 6/18- 6/36 (2.5%), 9 had between 6/60-1/60 (7.5%), 1 had CFCF (0.8%), 7 had PL (5.8%), 4 had no perception of light (3.3%).

Figure 15: Visual outcome



8 yr old boy with burns injury

Case of conjunctival laceration



Case of epithelial defect in the cornea

Subconjunctival hemorrhage

Periorbital edema and ecchymosis

Corneal tear with Iris prolapse

Lower lid tear

DISCUSSION

DISCUSSION

In this study involving 120 school going children a wide spectrum of ocular injuries were noted.

In our study 98 were boys(81.6%) and 22 were girls(18.3%) whereas in the study done by Rohit Saxena et al 65.1% were boys and 34.9% girls(4) and in the study done by Angelino Julio et al 71.8% boys and 28.2% girls were involved.

In our study most of the injuries occurred in age group between 11-15 years (52.5%) which is similar to the study conducted by Juan et al (58.1%) whereas a study by Ellen Strahlman et al showed that 40% injuries occur in this age group.

In our study right and left eye were involved in 46.6% cases and bilateral involvement seen in 6.6% cases whereas in a study conducted by Angelino Julio et al right eye was involved in 50.9% cases, left eye in 48% cases, both eyes in 1.1% cases. In a study by Ching-Hsing et al both eyes were involved in 9.2 % of the cases.

In our study injuries due to accidental fall caused 29.1 % of injuries which is more or less similar to the study by Angelino Julio et al where 28.9% cases occur due to accidental injury. RTA caused 14.1% injuries in our study whereas Angelino et all study showed 2.2% due to RTA. Sports caused 27% injuries in a study done by Ellen Strahlman et al.

Most common ocular manifestation was in the involvement of lids in our study 88.3% followed by conjunctiva- 80.3%. whereas Hamid Hosseini et al showed that lamellar laceration was more common 96% followed by lid involvement 22%. In our study lens was involved in 1.6% cases but in Hamid et al study only one case of significant lens involvement was found.

In our study orbit was involved in 14.1% cases and posterior segment in 5% cases but in a study bu Ching Hsing et al, orbit was involved in 6.1% cases and posterior segment in 3.4 % cases.

In our study significant loss of visual acuity(6/60 – no PL) was seen in trauma due to RTA(17.5%). Whereas in a prospective study conducted by Caroline J MacEwen et al, no injuries were caused by road traffic accidents and sporting activities was the commonest cause of injury. In a study conducted by Israel Figueiredo Junior et al 71.15% were involved in motor vehicle accidents and in a study by C.G.Thompson et al incidence of injuries from motor vehicle accidents were 6%.

Open globe injuries were seen in 11.6% cases and closed globe in 88.3% cases in our study. This is similar to the study by Juan C Serrano et al where closed globe injury occurred in 92% of cases. Whereas in a study by Shoja et al, open globe injuries(51.7%) were more than closed globe injuries (35%).

In our study at the time of presentation 1.6 % had a vision of no perception of light and 3.3% had no PL finally but in a study by Hamid et al.,

initially 9 % had no PL and finally 11% had no PL. This variation between the studies may be due to large number of study cases.

In our study final visual outcome of no perception of light is seen in 3.3% cases. Nearly all the patients who became blind suffered ocular injury due to road traffic accidents.

SUMMARY

SUMMARY

In this study 120 school going children who presented to Thanjavur medical college with history of ocular trauma were studied during a period of December 2015 to August 2017.

- 11-15years were the most common age group who presented with ocular trauma
- Boys have a significantly higher frequency of ocular injuries when compared with girls.
- Accidental injury was the most common mode of injury followed by injury with stick.
- However vision loss was more in trauma due to road traffic accidents.
- Unilateral eye involvement is more common than bilateral involvement
- The most common structure involved was lids followed by conjunctiva.
- The most common ocular manifestation is periorbital ecchymosis, edema .
- The most common conjunctival lesion was subconjunctival hemorrhage
- The most common corneal manifestation is corneal tear
- Closed globe injury is more common than open globe injury.
- About 9 children had optic nerve involvement.
- Among the orbital walls, lateral wall fractures is more common.

- Final visual outcome of no perception of light is more common in injuries due to road traffic accidents (3.3%)
- Optic neuropathy and globe rupture was associated with extremely poor visual prognosis. All those patients with globe rupture and optic neuropathy had a final visual acuity of less than 3/60

CONCLUSION

CONCLUSION

Though this study is too small to come to a meaningful conclusion, it clearly indicates that ocular trauma is the most common cause of ocular morbidity that affects especially the young. It can cause a lifetime of disability in children.

Among children boys are more prone to injuries than girls due to their aggressive nature and more involvement in outdoor activities.

An important finding in our study is that injuries due to accidental fall, injury with stick and thorn caused major ocular manifestations. Whereas gross visual damage in this age group occurred with road traffic accidents especially with cycling. Most injuries involved the anterior segment. The visual outcome of open globe injuries and injuries involving optic nerve had a poor prognosis.

Children cannot be fully blamed for their actions; parents and teachers need education in preparing the environment to be safe for children. Appropriate ocular protection and adult supervision for children must be stressed especially when using sharp objects. The most important aspect of pediatric trauma is prevention.

Better health care facilities must be provided in rural areas so that the delay in initiation of treatment is avoided. Prevention of accidents, early detection and appropriate management can prevent visual disability. The general public and school children should be educated about the irreversible nature of vision loss and the morbidity associated with these type of ocular injuries.

PART III

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BIBLIOGRAPHY

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PROFORMA

Name of the patient: age/sex:

Date:

Hospital no: Address:

History of present illness:

H/O Trauma:

H/O Pain:

H/O Photophobia / redness / watering:

H/O Defective vision:

H/O Headache/vomiting:

H/O Diplopia:

H/O Floaters:

Past history:

H/O Systemic medications.

H/O ocular surgery.

General examination:

Anemia - Lymphadenopathy –

Cardiovascular system – BP-

Respiratory system

Abdominal examination –

Central nervous system –

Ocular examination:

OD OS

Vision-

Forehead / adnexa –

Orbit –

Wall:

Margin:

Lids-

Tear:

Edema:

Ecchymosis:

Canalicular injury:

Others:

Conjunctiva –

Congestion:

SCH:

Tear:

Cornea-

Edema:

KPs:

Others:

Anterior chamber –

Depth:

Cells:

Flare:

Hyphaema:

Others:

Pupil –

Size:

Shape:

Reaction to light:

Synechiae:

Others:

Iris –

Colour /pattern:

Others:

Lens -

IOP-

EOM-

Retinoscopy -

Fundus –

Gonioscopy:

Investigations

1.Complete blood investigations :

complete blood count –

-

2.Radiological investigations:

3.Slit lamp examination:

4.B scan

5.others:

Provisional diagnosis:

Treatment :

MEDICAL:

1.Mydriatics / Cycloplegics:

2.Antibiotics:

Topical:

Systemic:

2.Steroids :

Topical:

Systemic:

3.Others:

SURGICAL :

Visual outcome :

Prognosis:

Follow up:

KEY TO MASTER CHART

ABBREVIATION	EXPLANATION
S.NO	Serial number
MOI	Mode of injury
CONJ	Conjunctiva
AC	Anterior chamber
EOM	Extra ocular movement
RE	Right eye
LE	Left eye
PL	Perception of light
CFCF	Counting finger close to face
No PL	No perception of light
E	Edema
EC	Ecchymosis
SCH	Subconjunctival hemorrhage
CCC	Circumcorneal congestion
ED	Epithelial defect
NRTL	Not reacting to light
SRTL	Sluggishly reacting to light
RAPD	Relative afferent pupillary defect

IP	Iris prolapse
TM	Traumatic mydriasis
ME	Macular edema
TC	Traumatic cataract
LW	Lateral wall

MASTER CHART

S.No.	NAME	AGE/SEX	MOI	EYE	VISION	LIDS	CON.	CORNE	SCLERA	AC	Iris/ pu	LENS	Fundu	EOM	ORBIT	DIAGNOSIS	Vn outc
1	sripriya	7/F	stick	RE	6/12.		SCH	ED								ED	6/6.
2	vinoth	15/M	stick	LE	PL+	E+EC	CCC	hazy		reaction	NRTL/i					Traumatic optic n	1/60.
3	yogesh	16/M	hand	RE	6/6.	E+EC	SCH									EC+SCH	6/6.
4	jabaseelan	16/M	thorn	LE	6/36.	E+EC	CCC	ED		reaction	Iritis					ED+ Uveitis	6/9.
5	suresh	13/M	stick	LE	6/12.	E+EC	SCH									E+EC+SCH	6/6.
6	saravana kumar	17/M	RTA	RE	6/6.	E+EC	Tear									conjunctival tear	6/6.
7	rahul	6/M	Finger	LE	6/6.		SCH									SCH	6/6.
8	moganesh	7/M	acc. Fall	LE	6/9.		SCH									SCH	6/6.
9	yogesh	8/M	burns	BE	6/6.	EC/sc										EC+ scalds	6/6.
10	gopiya	7/F	hand	LE	6/6.		SCH									SCH	6/6.
11	hariprasad	10/M	stick	LE	PL+	E+EC	SCH	Tear		variable	IP					E+EC+SCH+Corn	PL+
12	deepak	12/M	stick	RE	6/12.	E+EC	SCH									E+EC+SCH	6/6.
13	arunivel	7/M	stick	LE	6/9.	E+EC	Tear									conjunctival tear	6/6.
14	ajay	13/M	hand	LE	6/6.	E+EC	SCH									E+EC+SCH	6/6.
15	vignesh	17/M	acc.fall	LE	6/12.	E+EC	SCH									E+EC+SCH	6/6.
16	siva	12/M	stick	LE	2/60.	E+EC	CCC			reaction	IP/Iritis					corneal tear	6/60.
17	gokul	9/M	acc.fall	RE	6/6.	E+EC	SCH									E+EC+SCH	6/6.
18	yuga bharathi	5/F	acc.fall	RE	6/9.	E+EC	SCH									E+EC+SCH	6/6.
19	mohammed asif	13/M	hand	RE	6/9.	E+EC	SCH									E+EC+SCH	6/6.
20	gowtham	12/M	acc.fall	RE	6/6.	E+EC										E+EC	6/6.
21	pradeep	9/M	stick	LE	6/12.	E+EC	SCH			reaction	SRTL/					Traumatic uveitis	6/9.
22	palkannan	12/M	cracker bur	RE	PL+	E+EC	CCC	tear		variable	IP					rupture globe	PL+
23	sri santhosh	13/M	ball	RE	6/12.	E+EC	SCH				SRTL		ME			E+EC+SCH	6/9.
24	harish	11/M	iron rod	RE	2/60.	E+EC	CCC	tear	tear	reaction	IP/ Iritis					sclero corneal tea	4/60.
25	sangeetha	15/F	phenol	LE	6/12.	scalds	chem	ED								chemical injury	6/9.
26	selvam	11/M	ball	RE	6/36.	E+EC	SCH			hyphema	TM					TM	6/9.
27	nithish kumar	13/M	Acc.fall	RE	6/6.	E+EC	SCH									E+EC+SCH	6/6.
28	gowtham	11/M	Finger	RE	6/6.	E+EC	SCH									E+EC+SCH	6/6.
29	mukesh	15/M	thorn	RE	6/18.	E+EC		ED								E+EC+ED	6/6.
30	mahavishnu	15/M	ball	LE	6/6.	E+EC	SCH									E+EC+SCH	6/6.
31	Ilakiyan	17/M	thorn	LE	PL+	E	CCC	Tear		variable	NRTL	TC				Traumatic catara	2/60.
32	kaleeshwaran	16/M	ball	RE	2/60.	E+EC	SCH			Reaction	SRTL/					Traumatic uveitis	6/9.
33	hariharan	10/M	battery burs	LE	PL+	E+EC	SCH	Tear		variable	IP					Rupture globe	PL+
34	marimuthu	14/M	RTA	RE	1/60.	E+EC	SCH				RAPD					Traumatic optic n	CFCF
35	kanesh	15/M	Acc.fall	LE	6/24.	E+EC	SCH							Full	#LW	# lateral wall	6/9.
36	ebinezer	14/M	acc.fall	RE	6/18.	E+EC	SCH							Full	#LW a	# lateral wall and	6/9.
37	varshini	7/F14/M	stick	RE	6/12.		SCH	ED								ED	6/6.
38	priya	14/F	acc.fall	LE	6/9.	E+EC	SCH									E+EC+SCH	6/6.
39	ranjani	10/F	pencil	LE	6/36.	E+EC	Tear									Conjunctival tear	6/6.
40	nithya	16/M	hand	LE	6/6.		SCH									SCH	6/6.
41	kanimozhi	9/F	acc.fall	LE	6/6.	Tear	CCC									Lid tear	6/6.
42	sathyavathi	12/F	pencil	LE	6/36.	E+EC	SCH	ED								E+EC+SCH+ED	6/6.
43	Praveen kumar	11/M	stick	RE	6/6.		SCH									SCH	6/6.
44	Sundaraj	14/M	acc.fall	RE	6/9.	E+EC								full	# LW	# Lateral wall	6/9.
45	Ramadoss	15/M	RTA	RE	6/36.	E+EC							ME			ME	6/18.
46	Ravi	18/M	RTA	LE	6/9.	E	SCH									E+SCH	6/6.
47	Sasi sekar	17/M	RTA	LE	No PL	E+EC	SCH				RAPD			full	#Roof	Traumatic optic n	No PL
48	Veera	13/M	RTA	RE	1/60.	E+EC	SCH				RAPD					Traumatic optic n	2/60.
49	Pazhani	14/M	thorn	RE	6/12.			Abrasior								Corneal abrasion	6/6.
50	Jeyakanth	13/M	hand	LE	6/9.	E+EC	SCH									E+EC+SCH	6/6.
51	Vani	15/F	iron rod	RE	6/6.		Tear									conjunctival tear	6/6.
52	Ramesh	6/M	thorn	BE	6/12.		SCH	Abrasior									6/6.
53	Thiyagu	18/M	hand	RE	6/6.		SCH										6/6.
54	Saithanya	13/M	acc.fall	RE	6/12.	E+EC	SCH							Full	# LW	#Lateral wall	6/6.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
56	55	Balamurugan	16/M	Ball	LE	6/6.	E+EC	chem									E+EC	6/6.
57	56	Jansirani	18/M	stick	LE	1/60.	E	SCH					TC				TC	6/24.
58	57	Parthiban	17/M	RTA	LE	No PL	E	SCH				RAPD					Traumatic optic n	No PL
59	58	Johnson	12/M	stick	RE	6/6.	EC	SCH									SCH	6/6.
60	59	Kanagavel	12/M	stick	BE	6/12.	E+EC	SCH									E+EC+SCH	6/6.
61	60	Muthuram	12/M	hand	LE	6/6.	E+EC	SCH									E+EC+SCH	6/6.
62	61	Sachin	13/M	hand	RE	6/6.	EC	SCH									EC+SCH	6/6.
63	62	Backya	13/F	acc.fall	LE	6/6.		SCH									SCH	6/6.
64	63	Vetri	13/M	thorn	LE	CFCF	EC	SCH	Tear		Variable						corneal tear	6/60,
65	64	Muthuram	12/M	stick	RE	6/12.	EC	SCH									EC+SCH	6/6.
66	65	Pannerselvam	11/M	RTA	RE	PL+	E+EC	CCC	Tear	tear	variable						rupture globe	PL+
67	66	Ezhilarasan	10/M	thorn	LE	6/36.	EC	SCH	Abrasior								Corneal abrasion	6/6.
68	67	Kannan	10/M	stick	RE	6/6.	EC	SCH									EC+SCH	6/6.
69	68	Akbar Ali	9/M	stick	RE	6/6.	EC	SCH									EC+SCH	6/6.
70	69	Kannappan	8/M	RTA	RE	6/12.	Tear	SCH									Lid tear	6/6.
71	70	Gopal	14/M	hand	LE	6/6.		SCH									SCH	6/6.
72	71	Elango	13/M	acc.fall	RE	6/18.	E+EC	SCH						ME			Macular edema	6/12.
73	72	Sasikumar	17/M	stick	RE	6/6.	EC										EC	6/6.
74	73	Krishnan	17/M	RTA	LE	6/18.	E+EC	SCH									E+EC+SCH	6/6.
75	74	Manivannan	7/M	stick	LE	6/9.	E+EC										E+EC	6/6.
76	75	Latha	6/F	hand	BE	6/12.	E+EC	SCH									E+EC+SCH	6/6.
77	76	Dharman	13/M	acc.fall	RE	6/9.	E+EC								Full	# LW	#Lateral wall	6/9.
78	77	Mathivanan	15/M	thorn	RE	6/24.	E+EC		Abrasior								Corneal abrasion	6/6.
79	78	Prithvi Raj	12/M	Ball	LE	6/12.	E+EC	SCH	Abrasior								E+EC+ Corneal a	6/6.
80	79	Subramani	10/M	Ball	RE	6/6.	E										E	6/6.
81	80	Thangavel	10/M	Ball	LE	1/60.	E+EC	SCH				RAPD					Traumatic optic n	2/60.
82	81	Chithra	13/F	acc.fall	LE	6/9.	EC	SCH									EC+SCH	6/6.
83	82	Savitha	15/F	acc.fall	LE	6/24.	E+EC	SCH									E+EC+SCH	6/6.
84	83	Ramesh	11/M	RTA	RE	PL+	E+EC	SCH				RAPD					Traumatic optic n	No PL
85	84	Lavanya	8/F	acc.fall	RE	6/9.	E+EC	SCH									E+EC+SCH	6/6.
86	85	Kavitha	14/F	stick	RE	6/12.	E+EC										E+EC	6/6.
87	86	Manigandan	12/M	RTA	RE	PL+	E+EC	SCH	Tear	tear	variable						rupture globe	PL+
88	87	Akashavarshini	10/F	Iron nail	LE	PL+	E+EC	CCC	Tear		variable	IP					corneal tear	PL+
89	88	Marudhan	14/M	acc.fall	LE	6/12.	EC									# Roo	#Roof	6/6.
90	89	Senthil	6/M	stick	LE	6/12.	E+EC	SCH									E+EC+SCH	6/6.
91	90	Kumar	9/M	acc.fall	RE	6/9.	E+EC	SCH									E+EC+SCH	6/6.
92	91	Nakulan	14/M	stick	LE	6/6.	E+EC										E+EC	6/6.
93	92	Vijayendran	10/M	acc.fall	LE	6/6.	E									# floo	# Floor	6/6.
94	93	Akila	12/F	hand	BE	6/6.	E+EC	SCH									E+EC+ESCH	6/6.
95	94	Balaji	13/M	stick	BE	6/6.	E+EC	SCH									E+EC+SCH	6/6.
96	95	Aravindh	11/M	acc.fall	LE	6/6.	E+EC									#roof	#Roof	6/6.
97	96	Rajesh	18/M	Ball	RE	2/60.	E+EC	SCH			Hyphem	TM					Hyphema	6/12.
98	97	Vijay	13/M	Acc.fall	RE	6/6.	E+EC										E+EC	6/6.
99	98	Malathi	10/F	hand	RE	6/12.	E+EC	SCH									E+EC+SCH	6/6.
100	99	Mahamani	15/M	iron rod	LE	6/18.	E+EC	Tear									Conjunctival tear	6/9.
101	100	Lalitha	16/F	acc.fall	BE	6/9.	E+EC	SCH									E+EC+SCH	6/6.
102	101	Sobin	14/M	acc.fall	LE	6/9.	Tear	CCC									Lid tear	6/6.
103	102	Thiyagarajan	15/M	RTA	RE	CFCF	EC	SCH				NRTL		ME			ME	2/60.
104	103	Sanath	15/M	acc.fall	LE	6/12.	E	SCH								# Floo	# Floor	6/6.
105	104	Bharath	18/M	acc.fall	RE	6/18.	E+EC	SCH									E+EC+SCH	6/9.
106	105	Thangamani	15/M	hand	LE	6/9.	E+EC										E+EC	6/6.
107	106	Thomson	16/M	acc.fall	RE	6/12.	E+EC	SCH									E+EC+SCH	6/6.
108	107	Raman	12/M	acc.fall	RE	6/6.		SCH									SCH	6/6.
109	108	Pandiyan	18/M	acc.fall	RE	PL+	E+EC	SCH				RAPD				# LW	Traumatic optic n	No PL
110	109	Ramakrishnan	9/M	hand	RE	6/6.	E+EC										E+EC	6/6.
111	110	Mani	18/M	RTA	RE	1/60.	E+EC	SCH				RAPD					Traumatic optic n	1/60.
112	111	Raja	16/M	RTA	LE	6/60.	E+EC	SCH						ME			ME	6/12.
113	112	Kumaresan	18/M	acc.fall	RE	6/9.	E+EC									# LW	#Lateral wall	6/6.
114	113	Shankar	10/M	acc.fall	RE	6/12.	E+EC	SCH									E+EC+SCH	6/6.
115	114	Moorthi	16/M	acc.fall	LE	6/9.	E+EC										E+EC	6/6.
116	115	Vennila	18/F	Ball	LE	2/60.	E+EC	SCH			Hyphem	TM					Hyphema	6/12.
117	116	Krithika	12/F	acc.fall	BE	6/6.	E+EC										E+EC	6/6.
118	117	Balaji	13/M	hand	LE	6/6.	E										E	6/6.
119	118	Aravindh Kumar	12/M	acc.fall	LE	6/12.	E	SCH								# Roo	#Roof	6/9.
120	119	Senthil	18/M	RTA	LE	PL+	E+EC	SCH	tear	tear							rupture globe	PL
121	120	Akilan	11/M	RTA	LE	6/36.	E+EC	SCH						ME			ME	6/9.
122																		